LISBON SCHOOL OF ECONOMICS & MANAGEMENT
UNIVERSIDADE DE LISBOA

MASTER

FINANCE

MASTER´S FINAL WORK

DISSERTATION

THE SUITABILITY OF THE SWEDISH PENSION SYSTEM TO THE PORTUGUESE CASE

ANA ISABEL BEZELGA BOLETO

OCTOBER - 2016

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SUPERVISION:

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Abstract

Since the beginning of the 21st century much has been discussed regarding the future sustainability of the Portuguese social security system, some argue it is sustainable while others regard it as unsustainable. The main factors for the unsustainability of the system are centered in the decreasing fertility and birth rates, complemented with the reaching of the retirement age of the baby-boom generation. In this sense, defendants of the unsustainability claim that a change of paradigm should occur, namely the adoption of a notional-defined contribution system like the Swedish model represents the most viable solution, as it displays an automatic mechanism that ensures the system balance.

To better understand if the Swedish model would be viable to the Portuguese case, it is developed in this master's final work a simulation model, where the Portuguese system would apply the Swedish model in the same year as Sweden did. Finally, conclusion regarding both financial and social impact of this adoption are drawn.

Key-Words: social security, pension, defined-benefit, defined-contribution, notional-defined-contribution, Pay-As-You-Go, fully-funded, notional pension wealth, automatic balancing mechanism.

Resumo

Desde o início do século XXI que a sustentabilidade futura da segurança social portuguesa tem sido muito discutida, sendo que alguns autores argumentam que esta é sustentável, enquanto outros a consideram insustentável. Os principais fatores apontados para a insustentabilidade do sistema são as decrescentes taxas de fertilidade e de natalidade, bem como o alcance da idade de reforma pela geração 'baby-boom'. Neste sentido, os defensores da insustentabilidade do sistema argumentam que deveria realizar-se uma mudança de paradigma, nomeadamente a adoção de um sistema de contribuição nocional definida semelhante ao modelo sueco, cujo representa a solução mais viável dado dispor de um mecanismo automático que garante o balanceamento do sistema.

Para melhor entender se o modelo sueco seria viável para o caso português, é desenvolvido neste trabalho final de mestrado um modelo de simulação em que Portugal aplicaria o modelo sueco no mesmo ano em que a Suécia o fez. Por último, são retiradas conclusões sobre o impacto financeiro e social que tal adoção teria.

Palavras-chave: segurança social, pensão, benefício-definido, contribuição-definida, contribuição nocional definida, repartição, financiamento por capitalização, riqueza nocional de pensão, mecanismo automático de balanceamento.

Acronyms list:

ABM – Automatic Balancing Mechanism

CGA – Caixa Geral de Aposentações

CPI – Consumer Price Index

DB – Defined-Benefit

DC – Defined-Contribution

EMU – European Monetary Union

EU – European Union

FDC – Financial Defined Contribution

FF – Fully-funded

GDP – Gross Domestic Product

IGFCSS – Instituto de Gestão de Fundos de Capitalização da Segurança Social

IMF – International Monetary Fund

INE – Instituto Nacional de Estatística

NDC – Notional Defined Contribution

NPW – Notional Pension Wealth

OECD – Organization for Economic Cooperation and Development

SSI – Social Support Index

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I. Introduction

Since the beginning of the 21st century much has been discussed regarding the future sustainability of the Portuguese social security system, some argue it is sustainable (Rosa, 2013; da Silva et al., 2004), while others regard it as unsustainable (Bravo, 2013; Mendes, 2011). Many defendants of the unsustainability claim the majority of alleged problems would be solved with a change in paradigm: the introduction of a notional-defined contribution scheme resembling the Swedish model.

Hence, the first point to consider before the formulation of an opinion, is the reasoning for the existence of social security systems, where the vast majority of the authors state the main reason is poverty relief (Brown, 2008), either in the form of pensions for the elderly or even unemployment subsidies or similar. Moreover, some scholars (Spicker, 1993) disagree that poverty relief is the main reason, regarding all reasons as equally important. The principles of a social security system are underneath the tiers created, the vast majority of the authors (Barr & Diamond, 2009) proclaim a three tiers model while others (Holzmann, 2005) prefer a five tiers model claiming it deals better with multiple objectives and risks.

The second point to consider is the possible schemes for the pension system: a defined-benefit (benefits are stablished in advanced) or a defined-contribution (contribution rate is stablished in advanced) scheme, and it can be financed in a Pay-As-You-Go (current contributions are used to pay current benefits) or fully-funded (an individual´s contributions are used to pays their pension in future) basis. From these combinations the notional defined contribution scheme results from a defined-contribution scheme financed in a PAYG logic.

The last issue to completely understand if a pension system is sustainable is to comprehend the worldwide evolution of pension systems and its reasoning, especially for the past 35 years, where these can be divided into two major periods/changes of paradigms: from 1981 to 2004 and since 2004. According to Orenstein (2013) several reasons lie in the 'privatization' trend started in 1981: The Chilean change for a fully-funded and defined-contribution scheme; demographic aging and budget deficits (Brooks, 2009); and the transnational campaign first conducted by the Chile and later by the World Bank (citing Madrid, 2003; Orenstein, 2008). Concerning the period from 2004 onwards, the reasons for the second change were: failure of the Chilean and Argentinean model to achieve a better coverage rate and to be more efficient (Kritzer, 2008); the combination of the 2008 financial crisis and the fiscal rules some countries might face (Casey, 2014); the World Bank reprove of the campaign it had pursued (citing Kay & Sinha, 2008); and the Chilean admission of failure of the fully-funded defined-contribution model.

Gathered all the necessary basic knowledge on pension systems, the aim of this master's final work is to conclude whether the implementation of an NDC scheme resembling the Swedish model would be suitable for the Portuguese case. In this sense, a simulation model is performed, where Portugal would implement an NDC scheme like the Swedish model and this would be enforced from 1999 onwards, equal to the Swedish process. Therefore, the answer for the question lies in the comparison of the simulation results with historical levels.

This work begins by presenting principles of a social security system, then briefly defines the possibilities of a pension system design and the recent worldwide context. The third chapter characterizes both the Swedish and the Portuguese schemes and displays some authors arguing on the systems sustainability. The fourth chapter exhibits the

simulation model building, while the fifth contents some conclusions on the suitability of the Swedish model in Portugal. On chapter six the simulation model limitations and some future investigation ideas are presented. Finally, chapter seventh concludes.

II. Literature Review

It is of most importance to realize the guiding principles of a social security system to better understand why it functions in a certain manner. Moreover, it is equally important to comprehend the most used schemes and funding possibilities to recognize their consequences on current and future pensioners. This chapter presents a brief literature review on those matters.

1. Guiding principles of a pension system

Quoting Brown (2008), *what should be the priorities in any well-designed social security pension system?*

It is widely accepted in the literature that poverty relief is a priority, either in the form of pensions for the elderly, unemployment subsidies to prevent people to face poverty, and benefits to people with low incomes. However, some authors claim this is the number one priority (Brown, 2008), while others (Spicker, 1993) claim this is as important as social protection, for example.

Furthermore, Brown (2008) and Holzmann (2005) claim a social security system should provide a sufficient and acceptable living-standard in the post-retirement stage (consumption smoothing). An acceptable replacement ratio must therefore exist in each regional system either by the pension amount or, if necessary, with complementary funds.

The solidarity goal (Brown, 2008) can be combined with progressive redistribution (Knox & Cornish, 1997) in an equitable national pension system, in the sense that income should be transferred from high income contributors to low income contributors (or from

contributors to people who do not contribute) although, there should be a ceiling in the redistribution process in order not to disincentive (high) income contributors to participate in the social security system through non-compliance or by staying out the formal economy. Knox & Cornish (1997) argue an equitable national pension system should also consider horizontal equity, i.e. similar benefits should be provided to individuals in the same circumstances. Moreover, on equitable national pension systems, lifetime contributions ought to be related with benefits, ensuring those who contribute more to the system, also receive more. On this sense, the authors consider that a national pension system can only be perceived as fair by its citizens if they understand it. Therefore, the social security system must be clear and comprehensible, being transparency a crucial factor.

Brown (2008) also considers other principles, such as: contributions/taxes should not be too high in order not to disincentive employers to hire new employees; the system ought not to create too large benefits that would discourage citizens to safe for retirement; the system should prevent incentives for contributors to leave the active life prematurely; and the system should not encourage unnecessary absences from the active life.

Finally, there is a consensus among authors (Barr & Diamond, 2009; Knox & Cornish, 1997) that it is unrealistic to have a social security system that satisfies all requirements, although these must be considered.

2. Framework

a. Design of a pension system: tiers, schemes and funding

Usually the stated principles are associated with the three tiers of a social security system - although there are other possible structures. The first tier is related to the principle of poverty relief (redistribution function), it is mandatory and generally publicly

managed; the second tier is associated with the consumption smoothing principle, it is also usually mandatory and can be either publicly or privately managed; and the third tier is voluntary, related to savings, aiming to enlarge individual choice to save more for retirement, and has a funded basis (Barr & Diamond, 2009; Barr, 2002).

However, the World Bank suggests a five tier model[1] (Holzmann, 2005), arguing that experience proved that a multitier design deals better with multiple objectives and risks of pension systems.

Concerning the possible schemes and their traditional conception, a social security system can be a defined benefit or defined contribution. The former ensures a benefit will be paid in retirement, based on a pre-established benefit equation, while a defined contribution plan establishes a fixed contribution rate throughout a worker's active life and so, the retirement benefit is the result of the accumulated contributions and the provided investment return by financial markets

In terms of funding, a social security system can be funded or unfunded. If on one hand in a funded system a worker's contributions are used to pay their own benefits in the future (fully-funded scheme), on the other hand, in an unfunded plan a worker's contributions are used to pay current pensioners benefits (Pay-As-You-Go).

In the literature, some combinations of schemes and funding have a specific designation such as the financial defined contribution scheme – a fully-funded defined contribution plan, in which the worker's rate of return is given by the markets – and the

[1] Zero tier – non-contributory basis financed by the state, related to the principle of poverty alleviation, aiming to provide a minimum level of protection; first tier – mandatory and liked with contributions linked to earnings and financed in a PAYG matter to address individuals' myopia, uncertainty of life expectancy, risks of financial markets and others; second-tier – mandatory and a FDC scheme; third tier – voluntary and may assume various forms; DB or DB, individual savings for the retirement stage, disability, death and others; fourth tier – assumes the form of a non-financial tier, allowing individual to have access to informal support (such as family support), formal social programs (such as health care and housing) and other individual financial/non-financial assets (such as home ownership) (Holzmann, 2008).

notional defined contribution scheme – which denotes a PAYG defined contribution plan, where the implied rate of return is given by features established by the State which are linked to the economy development (Holzmann & Palmer, 2005; Brooks, 2009).

b. International evolution

In this section it will be revised some changes and its reasoning in worldwide social security systems in the last 35 years.

According to Orenstein's (2013), the last 35 years can be divided into two major periods in worldwide pension systems history: from 1981 to 2004 and since 2004 until presently. Moreover, scholars present several reasons for these trending changes.

In 1981, Chile changed its DB and PAYG scheme to a privately managed FDC system (Mesa-Lago, 2009). From that period until 2004, Orenstein (2013) states that more than 30 developing countries located in Latin-America, Central and Eastern Europe, Asia and Africa have also followed the same pattern in terms of social security financing. The author also argues that scholars have different explanations for the financing change to fully-funded schemes during 1981-2004: domestic economic factors, such as demographic aging and budget deficits (citing Brook, 2009); international factors, such as the spread and mimic within peer countries (citing Brooks, 2005; Weyland, 2005) and the influence of the transnational campaign started by Chile and later conducted by the World Bank (citing Madrid, 2003; Müller, 1999, 2003; Orenstein, 2008; World Bank, 2006).

Concerning domestic factors, Holzmann (2013) claims that the demographic aging factor was motivated by the argument that a fully-funded scheme would solve by itself the situation and the verified high rates of return during the period would continue in the

future[2]. Regarding the budget deficits, Orenstein (2013) argues that the adoption of a fully-funded scheme was attractive to governments' since it would force people to save for retirement in individual accounts and so states could reduce the guarantees level.

Regarding the international factors and more specifically the spread and mimic within peer countries factor, Brooks (2005) expected the probability of private pension system's adoption in a given country to increase as the proportion of peer countries implementing it rises. This actually materialized, concluding that there is a powerful interdependence logic in Latin-America, Eastern and Central Europe and Central Asia, although there is no significant relation in OECD countries.

However, Orenstein (2013) considers that the above factors did not play the major role, being this played by the World Bank in its 1990's statement that privatizing pension systems would solve population aging problem – transnational campaign factor.

One could argue the change back into the PAYG paradigm was due to the 2008 financial crisis but Orenstein (2013) disagrees, mentioning the paradigm started to change by 2004/2005. In this regard, two explanations for this new change are pointed: fiscal and ideational explanations. Concerning fiscal explanations, Kritzer (2008) posits that in Chile and Argentina the fully-funded scheme failed to achieve a better coverage rate, and instead it decreased, as well as it registered an enormous proportion of administrative costs, which reduce drastically the retirement income. Moreover, Orenstein (2013) records the cost of changing from a PAYG to fully-funded scheme, which amounts to a few percentage points of GDP each year, as benefits are still paid by State but the amount of contributions received decreases significantly. Furthermore, Casey (2014) reminds that the combination of the financial crises of 2008 with the fiscal rules countries from the EU

[2] Orenstein (2013) claims in the 1980's returns on capital were higher than labour returns.

justifies the permanent/temporary abolishment of fully-funded schemes: in 2008 Hungary applied for a bailout to the IMF and in 2011 all second-tier contributors (fully-funded tier) were transferred again into the public pension scheme and the fund money was used to diminish government debt and finance current expenditure; Portugal[3] and Ireland[4], two other countries that required a bailout from *troika*, also nationalized private funded schemes as well as other countries. On the same logic, other nations followed a similar path, influencing private pension funds investment decision – such as the United Kingdom and Netherlands – or absorbed reserve funds before the stablished moment – such as France, Spain and Poland. However, the EU case was not unique as it occurred in other locations in the world with, e.g., the abolishment of the private system and integration in the public system in Argentina in 2008 (Mesa-Lago, 2009).

Regarding ideational explanations, Orenstein (2013) concludes that these present the most feasible reasons for the new private systems abrupt stop in 2005 throughout the world. The first ideational explanation presented by the author (citing Kay & Sinha, 2008) is the fact that, in 2006, an internal evaluation report of the World Bank reproved the campaign it had pursued in supporting the creation of private pension systems in countries which did not fulfilled the necessary preconditions and failed to accomplish issues of coverage and adequacy of pension systems. The author mentions this marked the cessation of new private pension systems. The other explanation given by the author highlights the Chilean recognition that the fully-funded scheme failed some key objectives (mentioned above) and thus, Chile transmitted a strong signal to the world that the implemented model was unsustainable and a revision was required.

[3] The national telecom and banks pension funds, which amount, respectively, 1.5% and 3.5% of the GDP.
[4] Universities and other public agencies pension funds.

In sum, ideational factors by mid-2000 combined with the global financial crises of 2008 changed individuals' attitude regarding the viability of financial markets in comparison to public provision of pensions.

III. The Portuguese and Swedish social security systems

It is of most importance to understand social security systems in terms of their functions and characteristics before the creation of any empirical model or evaluation. In this context, this chapter will present a brief characterization of the perished Swedish model that existed till 1999, the current Portuguese and Swedish systems and, finally, some critic analysis regarding social and economic sustainability of the Swedish model.

1. The Swedish public pension system

a. Brief characterization

Cheng (2010), Palme (2005) and Scherman (1999) provide a brief overview of the Swedish social security system prior to the existing model. Established in 1913 as the first national scheme in the world[5], it was characterized as a mandatory DB model financed in a PAYG logic. Moreover, it was composed by two parts: a flat-rate basic pension and an earnings related supplementary pension[6]. Hence, to be entitled to the former, an individual must have lived in Sweden for, at least, 40 years or worked for, at least, 30 years and, to be eligible to the supplementary pension, a career of, at least, 30 years is required (to receive a full earnings-related benefit, an individual must also had 65 years old (Palmer, 2000)). Furthermore, for those who received no or a very small supplementary pension, some additional cash and housing supplements was provided. Concerning the scheme's financial arrangement, the minimum protection was financed through employer's

[5] In 1913 it covered groups such as civil servants and military officers.
[6] Up to 7.5 base amounts.

contributions and the State budget and the earnings related pension was financed in a PAYG logic.

Moreover, the annual benefit was calculated as 60% of the average income during the highest 15 years in a 30 years' career diminished by one base amount (this corresponds to the pension base, which is indexed to prices) (Anderson, 2005).

Regarding the earnings ceiling design, this was price-indexed and so, with continuous growth in real wages, most people would be above the ceiling and, as a consequence, the increase in earnings would not correspond to an increase in benefit.

Concerning the motivations for the paradigm change, Scherman (1999) adds the problem of earnings ceiling design to the usual two pointed problems[7]. On the other hand, Cheng (2010) underlines the macroeconomic environment, stating the financial weakening on national indicators from the 1970's onwards: the average growth rate from 1960-1965 was 57%, being 1.2% between 1990-1995 (citing Ding Bing, 1996); social security expenditures in 1965 represented 7% of the GDP, which grew to 50.1% between 1991-1995 (citing Zhou Hong, 2006); government's financial deficit grew 212.8 times in just 31 years (1950-1981); and the transfer expenditures, in percentage of public debt, increased from 42.8 percentage points to 48.5% between 1974 and 1981 (citing Ding Bing, 1996).

The old-age pension system's revision resulted in a mixed model, with features never observed. According to Scherman (1999) the new model was also a compulsory national scheme that was fully enforced on January 1st, 1999. Characterized as an NDC scheme, it has as core ideas an unchanged contribution rate in the indefinite future and

[7] The usual two pointed problems are: the PAYG linkage dependency between financial performance and economic growth; and the effect of demographic fluctuations, more specifically, the retirement of baby-boomers' generation.

the system's financial sustainability throughout time. Moreover, it is composed by two subsystems: the minimum guaranteed and the earnings-related part.

Concerning the minimum guaranteed subsystem, it aims to provide a certain amount to all individuals aged over 65 who have no/low earnings-related pension, entering into effect for new pension on 2003 (Scherman, 2011; Anderson, 2005). Moreover, to be entitled to a full guaranteed pension one must have lived for, at least 40 years[8] in Sweden, otherwise it will be reduced by 1/40 for each year less than the required 40 years (Swedish Pension Agency[9]). Likewise, individuals in these conditions are also eligible to a housing supplement. Furthermore, it is financed by the general revenue in the sense that the State pays the difference between the guaranteed level and the earnings-related pension an individual is entitled. Additionally, it is means-tested, indexed to the cost-of-living and an individual can obtain some supplements through income-test measures (Könberg et al., 2006).

Regarding the earnings-related subsystem, its full effect will only materialize in 2044, until then a transitional period between the two systems occurs (Scherman, 2011). This subsystem can be divided in two parts: the PAYG and the individual account, which together sum a total contribution rate of 18.5% - equally delivered by employer and employee (Cheng, 2010; Palmer, 2000).

With regard to the PAYG part, Settergren (2001) notes that all working individuals must contribute with 16% to their notional account and this amount is transferred to the system's buffer fund. Moreover, it is from the latter that all pension in payment are paid and pension rights are registered. Additionally, pension rights and pensions in payment are indexed, respectively, to the average wage growth (income index) and average wage

[8] The required 40 years must have occurred between the ages of 16 and 64 years old.
[9] Website visited on June, 16th 2016 at 3 p.m.: https://www.pensionsmyndigheten.se/Welcome_en

growth discounted by 1.6% each year (Scherman, 2003). Furthermore, a full working-career is considered and there is no statutory pension age - each individual can choose from the age of 61 when they shall retire either partially (25%, 50% or 75% of a full annuity) or fully. Consequently, if one opts to retire partially, it is possible to combine earnings from work with the benefit - contributions will be considered on the benefit recalculation upon full retirement[10] (Palmer, 2000; Settergren, 2001; Anderson, 2005).

Concerning the individual account (Premium Reserve system), it represents the remaining 2.5% of the full mandatory contribution rate and can be privately or publicly managed[11] (Scherman, 2007). In this, each contributor must choose the funds they want to invest considering more than 700 possible investments – up to the maximum of five funds. Moreover, there is no guarantee against bankruptcies neither a minimum rate of return, being all the risk supported by individuals (Scherman 2007; Hapt & Kluth, 2013).

Given the previous information, each individual entitled to an earnings-related part will receive, whenever desired from the age of 61, the income from their notional and individual accounts[12]. Besides this, the 'safety net' from situations such as unemployment and early retirement end at the age of 65 years old (Scherman, 2011).

Parallel to the existence of a minimum pension, a ceiling on the earnings-related pension also reside in this system, with a ceiling level of about 50% above the average wage, it is indexed to the annual average wage growth (Palmer, 2000).

[10] Recalculation can occur any number of times.
[11] Although, the administration and insurance function of this sub-system are under the responsibility of the Premium Pension Authority, which, by stated law, should follow the same applicable rules as private insurance companies.
[12] The accounts can be 'called' at different moments, for example, an individual retiring at the age of 65 can choose to receive its earnings-related pension and delaying the receipt of its premium pension as a result of a low market performance.

Scherman (2006) states that the PAYG scheme contains two features intended to ensure the system's financial sustainability: the buffer fund and the automatic balancing mechanism. Regarding the buffer fund, at the outset of the new system, the accumulated funds under the old system were transferred to the buffer fund to serve as initial capital (Scherman, 2007). Moreover, and as previously mentioned, it is where both contributions paid and pensions in payment are registered. Consequently, the buffer fund accumulates capital in some periods and this is used to counter financial distresses in other moments. Considering the ABM, it is activated whenever the balance ratio (coefficient between the buffer fund assets and liabilities) is lower than one. Its activation implies a different indexation of pensions and notional pensions' capital: the balance index, which results from the multiplication of the income index and the balance ratio. Given this, whenever the balance ratio is lower than one, pensions and notional accounts will grow slower than the average income and, if in the next period the balance ratio in higher than one, pensions and notional accounts will still be indexed to the balance index, being therefore indexed at a higher rate than the average income growth. This process will occur until the moment the balance index equals the income index value (Settergren, 2001).

Finally, the balance ratio is also affected by other risk factors such as life expectancy and birth rate, given that as whenever the former increases and the latter decreases, the balance ratio is lower than one and the ABM is activated (Scherman, 2007; Settergren, 2001). In this sense, the system was designed to provide individuals with an annual statement of five pages regarding the forecast of their earnings-related and minimum guaranteed pension in face of different possible scenarios: The Orange Envelope (Anderson, 2005; Regúlez-Castillo & Vidal-Meliá, 2011).

b. Sustainability evaluations

The analysis about the sustainability of the Swedish pension system is often involved in discussion, some affirm it is sustainable while others argue it is not. The answer for such disagreement is, partially, related to the kind of sustainability in matter: financial sustainability or social sustainability.

In this topic, Scherman (2011) arises as one of the main criticizers of the Swedish pension system. Firstly, the replacement rate is not adequate, as it does not fulfil the target interval established in the framework legislation of 1994 for a person who works to a normal extent – the target range is between 55% and 65% and the number of years of a normal extent was never defined although, from the wording of the bill, 40 years' work is what is expected (Scherman, 2006). Such conclusions are made based on the 2005 National Strategy Report on Pensions, where an individual with constant average earnings for 40 years retiring in 2005 would have a replacement rate of 53% and, an individual in the same conditions retiring on 2050 would have a replacement rate of 40.4%. Moreover, in order for a person born in 1985 to obtain a replacement rate that neutralizes the increase effect in life-expectancy, they must work until the age of 67 years and one month[13], obtaining a replacement rate of 46%. However, if an individual wishes to pursue the 53% replacement rate that a person born in 1940 obtains, a retirement age of 69 years old would be necessary. In sum, 40 years of earnings at a contribution rate of 18.5% are not enough to produce the target replacement rate, 42 years or more are necessary. Moreover, the author records the difficulty of having a career with no interruptions and the struggle for old-age people to be employed to contrast with a required working career of 42 years

[13] An increase that represents an additional 25 months of work when compared to the 65 years old age retirement for people born in 1940 – these 25 months must represent a remuneration that is compatible with the average earnings before the 65th birthday.

or more (Scherman, 2007). In this regard, the average pension for the birth years' cohort of 1985/1990 is 17 p.p. less than for those born in 1940 although, from the 17 p.p., only 7 p.p. are related with the development of demography between the years of 2005 and 2050.

Secondly, although the favorable economic and wages development in the decade prior to 2007, retired people did not receive an increase in pensions in accordance to development and so, income disparities grew (Scherman, 2006, 2007). Furthermore, the adequacy of pensions is dependent on more than the system, the welfare arrangements provided for citizens should be observed. However, these and the ability to finance them is uncertain – representatives of regional and local governments argue about the unsustainability of the system (Scherman, 2007). Additionally, some problems of social justice are emphasized: indexation of the minimum pension to inflation, in comparison to the indexation to average wage growth in the earnings related part, implying that whenever the average wage increase more than inflation, the guaranteed pension decreases in comparison. Although the Swedish government finds appropriate such 'marginalization', this is contrary to most public pension systems and organizations throughout the world (e.g. OECD) that consider this a basic objective (Scherman, 2003). Moreover, access to the general welfare system and social insurance should be allowed to everyone. However, the Swedish 'safety net' terminates at the age of 65, which not only violates the latter principle as it is also incompatible with a society where individuals are required to work longer (Scherman, 2007).

Moreover, in the 1994 framework legislation was established that in the Premium Pension system a minimum guaranteed rate of return should be included and security should be above the diversity in management funds. Situation that did not occurred, as

currently there is no minimum guaranteed rate of return and more than 700 funds are available (Scherman, 2003). Furthermore, such sub-system incurs in high transaction costs as people are allowed to change fund whenever they desire - the Swedish Pension Agency states that, if no measures are carried-out, a 22% of total contributions of an individual joining at the age of 20 years, may have to be used to cover administrative costs if no measures are taken (Scherman, 2007).

Likewise, the reason for the ultimate reduction of pensions lies in the ABM as individuals bear all risks of financial imbalances in the earnings related part. Therefore, it does not fulfil the requirement of a balance between financial constraints and social objectives. (Scherman, 2007). Hence, this mechanism was only created due the perception that the system assumptions were overoptimistic - the buffer fund reserves were not sufficient to both cover pension liabilities and compensate the national treasury for the costs incurred in the system transition. Consequently, it does not create any space to monitor the generational contract neither the possibility to change the system in face of external shocks by achieving a fair balance between social objectives and financial constraints: whenever a disturbance occurs, current and future pensions are automatically reduced (Scherman, 2003). Recognizing this, Barr and Diamond (2011) sustain that in face of the ABM activation, a retiree is never able to recover the losses and catch-up the active population's pace of income[14]. Furthermore, in 1999 the ABM was presented as an extreme measure that would be activated only in extreme circumstances in order to ensure the system financial sustainability (Scherman, 2006; Könberg et al., 2006). However, it has been activated more frequently: in July 2011 the Pension Authority forecasted the decrease of the average monthly public pension of SEK 12 000 in 2009 to

[14] For detailed information on this subject, please see Barr and Diamond (2011).

SEK 11 300 in 2011, being the value registered in 2009 recovered only by 2014. On the other hand, salaries were estimated to increase from SEK 12 000 to 14 000 between 2009 and 2014. This mechanism was expected to affect pensions until 2020. Moreover, in the beginning of the 2008 crises[15] it was projected that if no measures were to be done, the ABM would diminish pensions by 4% in 2010 (Scherman, 2012).

Furthermore, the inexistence of a statutory pension age leads to lack of transparency and system's comprehension given that it is very hard for individuals to compile all information regarding the evolution of demography, economy and wages – which are uncertain – and conclude which is the best age to retire. (Scherman, 2007).

Finally, Barr (2006) says that a NDC scheme fails to allow efficient decision in consumption smoothing but later (Góra and Palmer, 2003) mentions that such system is efficient in the sense it does not aim to achieve a redistributive function among groups, rather it aims to fulfil a redistributive function within an individual's lifecycle.

In sum, Scherman (2003, 2011) considers that the current Swedish system is financially but not socially sustainable and it should not be followed by other countries. Moreover, by 2011, Sherman and Barr and Diamond stated the model is under revision due to the consequences of the 2008 crises on pensions. Also Chłoń-Domińczak et al. (2012) point out that in response to the crises, the ABM's valuation principle changed to a three-years moving average[16].

Valdés-Prieto (2000) concludes a notional account system with automated mechanisms is not financially sustainable in the short-run[17] in the real world as: 1) the

[15] The ABM was activated due the reduction of the buffer fund value by almost 30% (Kruse, 2010).
[16] The authors refer the Swedish Social Insurance Agency (2009) to indicate that the balance index in 2008 and 2009 was, respectively, 09672 and 0957 and, due to the change in principle valuation, this index was revised upwards, to 0.9826 in 2008 and 0.957 in 2009, diminishing the consequent reduction in pensions.
[17] Short-run financial stability is defined by the author as any measure that avoids reducing assets and issuing debt; they also define short-run as a period of one to two calendar years; they regard the long-term

hypothetical case of the number of contributors and contribution rate should remain constant over time; 2) the credited notional interest rate is the growth rate of contribution revenue[18] and; 3) *(i) the notional interest rate is the growth rate of contribution revenue; (ii) pensions are indexed to the growth rate of contribution revenue; (iii) pensioner balances are credited ex post the same notional interest rate as contemporaneous contributors; and (iv) the authorities do not interfere with mortality projections to achieve financial balance*[19]. Therefore, such system should have other financial adjustments mechanisms superimposed (e.g. government guarantees and repeated legislation).

The findings of Ishizaki et al. (2011), Lu et al. (2008) and Auerbach & Lee (2009) are consistent with the previous results. The former concluded that the adoption of a scheme like the Swedish model in Japan would not be financially sustainable in the short-run[20], as the automatic mechanism would be activated and the balance ratio would only be 1 approximately 29 years later. However, they consider the scheme is financially viable and would increase overall replacement rates in Japan in the long-run if some complementary policies are carried out, such as a reserve fund. Similarly, Auerbach & Lee (2009) also noticed the financial instability that is produced from a model identical to the Swedish, claiming that the internal rate of return is more vulnerable to variations in demography and economy than it is believed.

Moreover, Chłoń-Domińczak et al. (2012) design a simulation model to examine if the Swedish social security system (as well as the Italian) would financially endure in face of the following scenario: permanent decline in labor productivity and size of the

period as irrelevant for the study as the system situation in that period is always influenced by the political process.

[18] Except for the steady-state growth case.

[19] Except for the steady-state growth case.

[20] However, the concept of short-run here is rather different than in Valdés-Prieto (2000), it is considered 12 years.

youngest cohort and an increase in longevity at retirement. The study's conclusion indicated the system would be able to surpass the difficulties, albeit with moments with small shortfalls.

Furthermore, Boeri & Galasso (2012) focus on the consequences a dual labor market[21] implies on future pensioners' benefit. Emphasis is given to the importance of early contributions combined with the compounded effect on the pension calculation, where it can be concluded the most affected workers are the temporary works, who usually display discontinuous careers and consequently fail to accumulate contributions in the early stage of their working careers and therefore, do not benefit from the compounding effect – needing to postpone retirement.

Contrary to Scherman, Palmer is a major defendant of the introduction of an NDC scheme resembling the Swedish model. Palmer (2002) presents some advantages of introducing an NDC scheme in EU countries: breakage of the standardized life course model, by allowing people to choose when to retire; and separate the income sources from which the old-age pension and other benefits are paid to create transparency and eliminate some externalities - e.g. attempts to transfer costs from current to future generations.

To conclude, a consensus on the merits and on the sustainability of the Swedish social security model is far from being reached. Some authors focus on the financial sustainability of the system while others give more emphasis on the social aspect.

2. The Portuguese social security system

a. Brief characterization

The welfare-state in Portugal was born with the Revolution of 1974 with two fundamental pillars: the national health system and the social security system.

[21] A dual labor market consists in a separate labor market contracts for temporary and permanent workers and permanent.

The social security aim is to promote better and sustained conditions and levels of social protection, increase in reinforcement of equity and promotion of the system and its management. Moreover, until 1993 workers of public and private sectors were covered by different systems of protection and so, their contribution rate was different: the public sector was covered by CGA and the private sector was covered by social security. However, since 1993, workers from both sectors are obliged to enroll in the social security system, assuming an equal rate of contribution (Gouveia & Sarmento, 2002).

Similarly to other EU countries, social security is composed by a contributory and a non-contributory part. Moreover, it is currently composed by three sub-systems: citizens' social welfare allowances; complementary; and insurance-based system[22]: social welfare allowances represents the non-contributory part of the system, which aims to guarantee basic rights, equality of opportunities, promote well-being and social cohesion to all citizens (article n.º 26, Law n.º 4/2007) and is financed mainly through State Budget transferences (Guedes & Pereira, 2013); the complementary sub-system is an individual and voluntary regime, managed by the State or a private entity, that intents to provide complementary benefits to the insured-based sub-system (articles n. º 81, n. º 82, n. º 83 and n. º 85, Law n. º 4/2007); the insurance-based sub-system's objective is to compensate the reduction/loss of occupational earnings in case of sickness, maternity, paternity, adoption, unemployment, death, disability, work accidents and occupational sickness and old age (article n. º 52, Law n. º 4/2007). Consequently, only employees and self-employed are legally entitled to participate in this sub-system. Generally, the contribution rate is 34.75% of remunerations - 11% delivered by the employees and 23.75% by employers.

[22] Sistema previdencial, sistema de proteção social e cidadania e sistema complementar in Law nº4/2007.

Furthermore, current contributions to the system are used to finance current benefits. Therefore, it is characterized as a PAYG scheme. However, whenever a surplus occurs it is capitalized through financial markets and managed by the social security trust fund[23], working as a saving account in the event of deficit in the insurance-based sub-system (Guedes & Pereira, 2013).

In order to obtain the full old-age benefit, one must have contributed for 40 years[24] and fulfil the minimum age requirement. The latter is revised each year and is directly related to the average life-expectancy so, whenever it increases in a certain year, also increases the minimum age to be entitled to the full benefit[25] - the minimum age was 66 years and 2 months in 2015. Moreover, one can require the benefit before the normal age, although with a penalty that is also related to the average life-expectancy, the so-called sustainability factor[26] - according to the social security website it is 0.8698 for 2015. Hence, the benefit formula is the following*: Benefit = Reference remuneration * Global formation tax * Sustainability factor*[27]. Through this, one can register the major impact the sustainability factor has on the benefit.

Finally, and as seen previously, the benefit consists in a weighted calculation of all remunerations throughout a life-time career. Consequently, the Portuguese social security system is characterized as a defined benefit regime.

[23] Instituto de Gestão de Fundos de Capitalização da Segurança Social.
[24] Established from 2002 onwards by Decree Law n. º 35/02. Until this moment it was considered the best 10 from the last 15 years (Mendes, 2011).
[25] The equation to determinate the normal age to access the old-age benefit is: $m_n = \sum_{i=2015}^{n}(ALE_{i-2} - ALE_{i-3}) * 12 * \frac{2}{3}$, where m is the increase in the number of months to the normal age of benefit attribution in 2014 (66 years); n represents the years at which the benefit begins; and ALE is the average life-expectancy at the age of 65; this equation results from the revision that occurred in 2013.
[26] Sustainability factor = Average life-expectancy at age 65 in year 2000/Average life-expectancy at age 65 in the previous year to benefit payment.
[27] Reference remuneration = Total of yearly remunerations revaluated of all contributive period/ (number of civil years with record of remunerations up to the limit of 40 years * 14); Global formation tax is the number of civil years with relevant remunerations to record multiplied by the accrual rate (Indexante dos apoios sociais) – see appendix 1, table 1.

b. Sustainability evaluations

Many public individualities have discussed the sustainability of the Portuguese social security system, either claiming it is unsustainable and the Swedish scheme should be followed, or stating it is sustainable. However, most of these do not publish supportive documentation to their arguments. In this sense, this topic is shorter and centered in just a few authors.

Firstly, Mendes (2011) records the 1998's conclusion of the Social Security White Book[28] was that, in one hand the current balance of social security was sustainable whilst, on the other hand, in the long-term financial situation would deteriorate immensely as a consequence of the regime maturity and demographic evolution[29]. As a consequence, in 2002 some changes were implemented, such as considering the entire contributory career (40 years) in the benefit calculation. However, in the same year the European Commission forecasted a 10 percentage points'[30] increase in expenditures with pensions for Portugal between 2005 and 2050, conducting it for the group of countries classified as highly risky in terms of their public finances sustainability. In face of this, in 2007 the government implemented parametrical reforms: introduction of the sustainability factor in the benefit calculation; modular indexation of pensions to CPI, according to pensions' level and GDP growth[31]; and indexation of the minimum pensions to the social support index. These measures conducted to a re-evaluation of the country's long-term public finances sustainability to the group with medium risk. In author's opinion, there is the need to instore a structural reform in the system given the current contribution burden, the context

[28] Livro Branco da Segurança Social.
[29] The proportion of active population compared to people in retirement age would be progressively more unfavourable.
[30] To 21% of the GDP.
[31] Above a 2% GDP growth rate medium and high benefits are revised above CPI at -0.5 or 0.75 percentage points.

of economic crises and growing unemployment and the downward results of the political incentive to saving-for-retirement plan.

Secondly, Bravo (2013) is also a defendant of a structural reform's adoption. In this sense, two studies were performed: simulation of the long-run (2011-2060) sustainability of the Portuguese social security system; and the necessary changes in the system. Some conclusions of the first study reveal that the active population would decrease by 19.2%; the total dependency ratio would increase from 62.6% in 2011 to 93.9% in 2060; the support ratio[32] would decrease drastically from 1.17 in 2011 to 0.84 in 2053; the system's reserve fund would be exhausted in 2015; and the system's balance runs a deficit throughout the studied period. Concerning the second study, a four tiers NDC system is proposed – the virtual indexation to the real growth rate of contributions and GDP.

Thirdly, da Silva et al. (2004) conclude that social security can continue to play a major role in Portuguese citizens' life if a balance is considered between principals of social security system, economic and demographic legislation and updated legislation. The paper studies social security's actuarial and financial equilibrium both in the short-term (10 years) and in the long-term (50 years). The authors conclude there is a long-term actuarial imbalance in the previdential contributory subsystem, where from 2025 onwards benefits payment will exceed contributions and, by 2050 the imbalance will amount to 2.25% of GDP. In order to overcome the situation, a permanent reduction of 0.7% in growth-rate benefits expenditure, or an increase of 10% in the effective contribution rate on incomes is suggested by the authors since this is much lower than 34.75%.

Concerning Rosa (2013, 2015) and the social approach, the author notices that the expenditures with social protection in Portugal are lower than in the EU[33] to state that

[32] Number of contributors per pensioner.
[33] Either in percentage of GDP or in euros per inhabitant.

there is no real correspondence to the claim that the expenditures with social protection in Portugal are higher than the EU average. Moreover, according to INE, if there were no social transferences (including pensions) in 2011, 42.5% of the population would be at a risk-of-poverty, while with it the proportion is enormously lower, 18%. This difference is related to the existence of pensions - which reduce the percentage of people at-risk-of-poverty to 25.4% - and social subsidies - that diminishes this rate to 18%. The author mentions this opposes the IMF's report that the Portuguese pension system aggravates social inequalities and does not diminishes poverty.

Likewise, the author exemplifies through 'The Navigator Company' the impact in pensions that a transition from a DB to a DC scheme would imply: workers were promised a benefit complement that could attain 30% of income in the retirement moment at the end of 25 years of work. In this sense, employees hired an insurance company to evaluate if the change would be beneficial and concluded that only 0.5 to 2/3 of the complement would be received.

On the financial side of the system, the attributed difficulties are the result of the recessive policy imposed by the Government and *Troika*, as it has been presenting high positive balances[34] and the report from the Commission of the Social Security White Book concludes that until 1996, the non-contributed benefits were paid improperly with contributions from employees, when it should have been paid through State Budget (Louçã et al., 2016).

Furthermore, considering Rosa (2013) the system's financial sustainability is largely affected by economic growth in two perspectives: receipts (economic growth generates more employment alongside with an increase in the number of contributors),

[34] Until 2012, 10 676 million euros were accumulated in the Social Security Trust Fund.

and expenditures (a decrease in unemployment would lead to a reduction in the number of unemployment and social subsidies). The author exemplifies the positive effect that an economic growth policy has on growing employment: the loss of revenues due to unemployment was between 23 561 million and 28 489 million euros between 2000/2012. Moreover, the European Commission 2012's report concludes that if the established objectives concerning employment or the performance of the best performing countries were attained, the effects of population aging on pensions' expenditures proportion on GDP would be almost eliminated. In parallel, the 2015's Ageing Report of the European Commission states that the cost with the Portuguese social security system will decrease from 13.8% in 2013 to 13.1% of GDP in 2060. Consequently, in the author's opinion, as future costs with social security will be lower than the current values, the system is perfectly sustainable. Moreover, the report's assumptions do not accommodate parametrical reforms that have already been implemented, such as the increasing retirement age. Consequently, if those had been considered, future costs with social security would be even lower. Finally, the author concludes that the system's sustainability could be reinforced even in periods of crisis through a set of measures: effective combat against non-compliance and contributory fraud, effective recovery of debts to social security, changes of the system base of companies' contributions calculus from income to net value added and the diversification of social security financing source[35].

3. The Swedish model as a role model to the Portuguese case

The concept of an NDC was born in the beginning of the 1990's and aroused as the resolution for the impasse between the traditional DB schemes and prefunded financial

[35] For more information please see Rosa (2013) from page 132 to 139.

accounts (Holzmann & Palmer, 2012). In this sense, the World Bank is already performing studies to understand the implications such system had on those countries (Holzmann et al., 2012a; Holzmann et al., 2012b; Holzmann & Palmer, 2006).

The following chapter develops a simulation assuming Portugal adopted an NDC system similar to the Swedish model in 1999, the same date it was adopted in Sweden.

IV. The suitability of the Swedish social security system reform to the Portuguese case

The simulation replicates the new Swedish social security functioning for Portugal, both in the case of the balance ratio's change in valuation to a 3-years moving average and an annual balance ratio consideration. In addition, to take some conclusion concerning the adequacy of the models to the Portuguese case, the simulation results are compared to the historical data of the social security system from 1999 until 2014 and outlined considering the social and economic differences of Portugal and Sweden.

1. Hypothesis

The following model is inspired in the numerical explanation of the Swedish pension system provided by Auerbach & Lee (2009) and the Orange Report (2014).

The simulation concerning the adoption, in 1999, of the Swedish NDC model in Portugal, considers two versions: the first, assumes the average income with a balance ratio that is the average of the last 3-years from 2008 onwards (model 1); and, the second, with an annual balance ratio consideration throughout the period (model 2). However, to apply the simulation model, due to unavailable data, a set of hypothesis was formulated: a) for individuals born from 1938 and onwards, there is a full transition to the new scheme, while all others continue their careers covered by the old system; b) due to data constraints regarding the number of individuals with a given age, the employed people

instead of the active beneficiaries is used; c) the distribution of the employed people and old-age pensioners within a cohort is linear; d) the new system's pensioners are obtained as the difference in each two consecutive years of the total pensioners ; e) mortality table is considered constant along the periods: mortality table for the 2013-2015 years provided by INE[36]; f) the maximum life age is 100 years old; g) the age at which an individual has their first job is at 15 years old, in order to increase the accuracy with reality; h) the contribution rate to the earnings related pension system is 16%; i) pensions in payment under the old system are actualized at the inflation rate, although, if this is negative, no actualization is formulated; j) people with 71 years old or more in 1999 are considered to have retired at the age of 65 years old; k) people from 15 to 25 years old in 1999 are not considered covered by the old system to better accommodate the several changes throughout time in the minimum period of time to be entitled to a pension and to perform the calculation of 'the best 10 years from the last 15' to obtain the reference remuneration; l) to calculate the reference remuneration in the old system, it is used the not revalorized income in accordance with Portaria n.º 54/94 until the year of 1982, as well as the revalorization coefficients from Portaria n.º 464/2006 until the year of 1998[37]; m) the reserve fund is assumed to be capitalized at the effective annual real rate of return registered between 1999 and 2014 and available from the reports of IGFCSS.

2. The generic model

The following characteristics are the basis of the Portuguese NDC scheme:

1. An individual account (NPW), which increases with the yearly contributions (T) and the rate of return (growth of the average wage - r) of the previous period.

[36] To simplify calculations, it was used the mortality table of 2013-2015as it is the most recent one.
[37] These limit of years are due the unavailable data on the average wage prior 1982.

2. Some other factors influence the NPW, such as the probability of survival until next year for a given age, and the balance number (b) of two periods ago (from the 2008 onwards, it is considered the average of the previous three periods in model 1). In this sense, whenever the balance number is higher than 1, no NPW accommodations are required although, if the balance number registers a value lower than 1, the NPW's indexation will be transferred to the balance index (bindex), which combines the multiplication of the growth rate of the average wage and the balance ratio. The effects of these characteristics on NPW can be observed in the following set of equations:

$$(1) \qquad NPW_{t+1} = \begin{cases} \left[NPW_t\left(1 + r_t^i\right) + T_t\right] * p_{t+1,t+2}^i * 1, if\ b_{t-2} > 1 \\ \left[NPW_t\left(1 + r_t^i\right) + T_t\right] * p_{t+1,t+2}^i * bindex_{t-2}, if\ b_{t-2} < 1 \end{cases}$$

However, the NPW of people aged between 55 and 70 also considers the transference of NPW from people that decide to retire (P), as well as the death of other individuals within these ages:

$$(2) \qquad NPW_{t+1} =$$

$$\begin{cases} \left(\left[NPW_t(1 + r_t^s) + T_t\right] * p_{t+1,t+2}^s - P_{t+1}^s - P_{t+1}^s * \left(1 - p_{t+1,t+2}^s\right)\right) * 1, if\ b_{t-2} > 1 \\ \left(\left[NPW_t(1 + r_t^s) + T_t\right] * p_{t+1,t+2}^s - P_{t+1}^s - P_{t+1}^s * \left(1 - p_{t+1,t+2}^s\right)\right) * bindex_{t-2}, if\ b_{t-2} < 1 \end{cases}$$

3. The system's total NPW is, therefore, the aggregate notional pension wealth of individuals not yet retired.

4. The NPW is a virtual balance and, whenever individuals retire, their pensions will be an annuity based on the NPW at the retirement moment, where the economic annuity divisor is 1.6%.

5. In parallel to the indexation of the NPW is the indexation of pensions in payment, which are indexed to the growth rate of the average wage discounted at 1.6% as long as

the balance ratio is higher than 1 and, in the opposite situation, are indexed to the balance index:

$$(3) \qquad P_{t+1} = \begin{cases} \frac{P_t(1+r_t^S)}{1+0{,}016} * 1, if\ b_{t-2} > 1 \\ \frac{P_t(1+r_t^S)}{1+0{,}016} * bindex_{t-2}, if\ b_{t-2} < 1 \end{cases}$$

6. The system's total cost with pensions is the addition of the multiplication of every pension for a given age and the number of annual old-age pensioners in the NDC system.

7. The process of indexation transference from the income index to the balance index is called the Automatic Balancing Mechanism activation.

8. Given the balance ratio importance in the amount of pensions in payment and NPW, a review of the balance ratio components is required. As previously mentioned, the balance ratio (b) represents the coefficient of the system's assets - the system's financial assets (assuming the reserve fund of the IGFCSS[38] in 1999: F) and the yearly total contributions (C)) – and liabilities (the aggregated notional pension wealth (NPW) and pensions in payment (P)):

$$(4) \qquad b_t = \frac{F_t + C_t}{NPW_t + P_t}$$

9. The consequences in pensions in payment and pensions rights in a year when the balance ratio in lower than 1, endure as long as the system's assets cannot cover liabilities. Accordingly, the ABM is only deactivated when the balance index is higher than 1.

10. Finally, the model only considers the new system's liabilities, being all pension in payment due the old system financed by the State through the issuance of bonds.

V. Results analysis

[38] Instituto de Gestão de Fundos de Capitalização da Segurança Social.

The simulation results include an evaluation of the financial and social aspects of the Swedish NDC application in Portugal, first concerning model 1; and second considering model 2.

Firstly, considering model 1, it can be observed that the ABM would not be activated in Portugal along the studied period (Appendix 2, table 2 and graphic 1). Alongside, the balance ratio lowest value is 1.09 in 2007, situation that is favorable to the country in comparison to the effective Swedish balance ratio – around 1.05 in 2001 and about 0.95 in 2008 (Orange Report, 2011). Considering the comparison between the simulation and the historical results, it is possible to observe through appendix 4, table 10 and graphic 3, that the growth rate of the average pension in payment in the simulated model is always higher that the effective growth rate (11,75% and 3,68%, respectively); although, if we observe the absolute pension level, this conclusion goes on the opposite direction: effective pension's level are higher than the simulated NDC pension - 428€ and 121€, respectively. Moreover, if we consider the volatility of pensions, the simulated NDC scheme (3,0%) is slightly more volatile than the effective pensions (2,8%).

Secondly, considering model 2, we can observe that the ABM would be activated between the period of 2010-2014 (appendix 2, table 3 and graphic 2). Despite this, the income growth rate is positive and sufficient to cover the balance ratio's negative impact in pensions in payment, apart from 2013. Consequently, in 2013 pensions in payment decrease by 2.2% (3€) in comparison with a non-ABM activation – this is mostly due to the balance index of 0.82 in 2011 (Appendix 3, tables 4 to 6). In parallel, the same conclusions are withdrawn to pension rights, which in 2013 reveal an average decrease of 23.2%, in comparison with the situation of an inexistent ABM – the average NPW decrease from 31 377 to 23 418 euros, a 7 957 euros' difference (Appendix 3, tables 7 to

9). However, in 2012 the balance index displays a value of 1.05, allowing pension rights to increase by 24.1%, on average, in 2014- in 2015 the ABM would be deactivated due the higher than one balance index value in 2013. Additionally, it is important to refer that the considered balance ratio's value for 2011 and 2012 are highly influenced by the reserve fund's rate of return: -13.39% and 20.64%, respectively. Considering the comparison between the new system's introduction and the historical scheme's, it is possible to observe through the growth rate of the simulated pension is always higher than the effective pension, apart from 2013. (Appendix 4, table 11 and graphic 4): 11,62% and 3,68%, respectively. However, it should be recorded that the simulated absolute average pension level is lower than the effective pension: 116€ and 428€, respectively; and the historical pension is much less volatile (2,8%) than the simulated one (7,1%). Due this, old-age people face some unpredictability in their pension's level, never truly knowing if it is going to decrease or increase next year.

In light of both models results, the Portuguese context should be considered: the effective average old-age pension between 2001 and 2014 is 428.93€, a value that is considered low given that the national minimum wage, in 2014, was of 485€[39] [40]. Thus, the simulated NDC scheme would produce much lower pension, as it would reach, at maximum, 200€ with model 1 and 188€ with model 2.

Additionally, it is equally important to state the expected impact of the NDC model in Portugal when considering other social indicators, as well as its position in relation to Sweden, EU and the EMU. Firstly, considering the S80/S20 (appendix 5, graphic 5) and the Gini coefficient (appendix 5, graphic 6), the lower simulated pensions in payment

[39] Source: Pordata (http://www.pordata.pt/DB/Portugal/Ambiente+de+Consulta/Tabela).
[40] Although in 2014 the average effective pension is 500.81€, slightly above the minimum wage.

than the historical level would conduce to the increase of the Portuguese recorded values, situation that would conduce to higher income disparities between the population as well as increasing the gap with Sweden, EMU's and EU. Secondly, regarding the population at risk of poverty over 65 years, a deterioration of it would be expected – in historical data (appendix 5, graphic 7), Portugal displays a higher proportion that the other studied regions, about 22.8%, on average, while Sweden and the EMU registered 17.1%. Likewise, the old-age dependency ratio (appendix 5, graphic 8) would also increase, situation that would most probably drive Portugal (26.77) to similar average values of Sweden (27.81) and EMU (26.81)[41]. In this sense, it is already forecasted a higher increase in the old-age dependency ratio for Portugal than for the other regions (appendix 5, graphic 9) therefore, considering the smaller impact of the NDC system in pensions increase than the current scheme, it would be expected an even higher increase in the Portuguese forecasted old-age dependency ratio.

Concerning the financial implications of the NDC scheme introduction, it is utterly important to understand what happened in Sweden to better realize what could be expected to occur in Portugal. In this sense, it is analyzed in first place the social security scheme's administration cost. Through appendix 6, graphics 10 and 11, it is concluded that the adoption of the NDC scheme in 1999 conduced, irreversibly, to the increase in administrative costs from 0.4% of the GDP in 1998 to a permanent value around 0.6%, as well as an enormous increase in administrative costs per inhabitant[42] from 110 euros in 1997 to around 200 euros from 2001 until 2013. A consequence of the increase in administrative costs is the loss of resources that could be allocated to each person's pension, which could increase it. Conversely, the cost with old age pensions remained

[41] Although Portugal exhibits lower old-age dependency values, it displays an increase tend
[42] Values in constant prices of 2005.

stable in Sweden from 1999 until 2008 (around 8% of the GDP), increasing afterwards – this is partially due the contraction of the growth rate of GDP (appendix 7, graphic 13) – while in Portugal it always increased rapidly through the studied period of 1998 – 2013 (appendix 6, graphic 12).

In sum, the adoption of the Swedish NDC model in Portugal would be financially viable, given it would always adapt the system in face of shortfalls and Sweden proved this scheme stabilizes expenses with pensions. However, concerning the social consequences, it would deteriorate the already low current and also future pensioners' life-conditions, being, therefore, not socially viable.

VI. Limitations and future research

It is worldwide recognized the real-world complexity cannot ever be included in any simulation model, mostly due to the uncertainty factor as well as all other variables that can affect the results that are unmeasurable, e.g. people expectations. Therefore, models are produced with limitations and the simulation produced in chapter four is no exception.

The lack of available data conducted to the assumption of a set of hypothesis which do not exactly correspond to reality and limit the model: a) generally, and especially after the 2008 financial crisis, people exhibit broken careers and so, it is a too optimistic assumption to consider that people have a 'non-stoppable' career; b) to simplify the calculations it was used the most recent mortality table (2013-2015) throughout the studied period, although it should have been used the biennial mortality tables provided by INE to produce more accurate results considering the demographic effect on pension rights and pension in payment; c) the 1999's initial capital transferred to the buffer fund represents the effective public pension reserve fund value of 2001 – therefore, the balance

ratio values are slightly biased; d) the use of the general contribution rate of 16% as the universal rate, as well as the number of employees instead of the number of active beneficiaries produced overestimated results in the sense that the contribution rate is not the same for all sectors of activity; e) it is assumed that all individual from the age of 71 or more retired at the age of 65 years old, while, in fact, the majority of them most probably retired earlier; f) in face of the previous limitation's conclusion, it is therefore noted the simulated models do not allow for a flexible retirement age as the Swedish NDC system; and g) the non-consideration of pension rights and pensions in payment under the old system on the model allows for balance ratio's values higher than one, otherwise they would often be lower.

Secondly, future research could use the effective Portuguese contribution rate in the simulation, which is lower than the general 34.75% and higher than the Swedish rate of 16%. However, it can be expected the conclusions will not be different given that, in one hand it is true the system's assets increase but, on the other hand liabilities also increase. Moreover, it could be simulated a theoretical model where the Portuguese system would keep its characteristics of a DB and PAYG scheme but a mandatory complementary system resembling the Swedish NDC model would be implemented. However, it can be argued this would create an overburden in contributors, although it would also allow higher pensions.

VII. Conclusion

Since the birth of public pension system much has been discussed whether this should aim a given benefit at retirement or a contribution rate should be formulated in advance and, even if each individual should save for their own retirement or younger generations should support the pensioners' benefits. In this topic, a consensus will never

be reached, as beneath each position lie different normative approaches. From time to time the predominant current is a DB and PAYG system, being in the other moments the FDC scheme the premier current. More recently, a mix of these combinations was formulated, fevering even more the discussion on the best model to follow. Whenever a current is worldwide predominant, countries using other schemes suffer internal and external pressures to change it. In this sense, Portugal presents itself as an example of a country suffering from these pressures since the beginning of the 21st century. Most authors arguing the Portuguese social security system is not sustainable present as a solution the adoption of an NDC scheme in order to face the significant forecasted decrease in fertility rates and anemic/stagnation economic growth. Moreover, before the 2008 crises, the Swedish NDC scheme was the prevailing pointed model to follow. The crises and the subsequent years proved the Swedish system was not as robust as believed and nowadays authors propose more conservative NDC schemes. It is in this frame that this Master Final Work was developed: to perceive the suitability of the Swedish pension system in the Portuguese case – an historical approach since 1999. The study's conclusion proved that in financial terms the system would always endure as it would adjust automatically in face of shortfalls. However, and keeping in mind the several claims that pensions are very low, the adoption of the Swedish NDC scheme would have caused lower pensions. Therefore, it would have not prevented people to afford better life-conditions and abandon a situation of at-risk-of poverty. Once more, what is most important remains a normative issue of each individual. In this sense, and in face of this study, my personal opinion is that an NDC system should not be adopted and parametrical reforms should take place throughout time, given that it would be naïve to consider the current situation would endure.

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Appendix 1 – Global formation tax

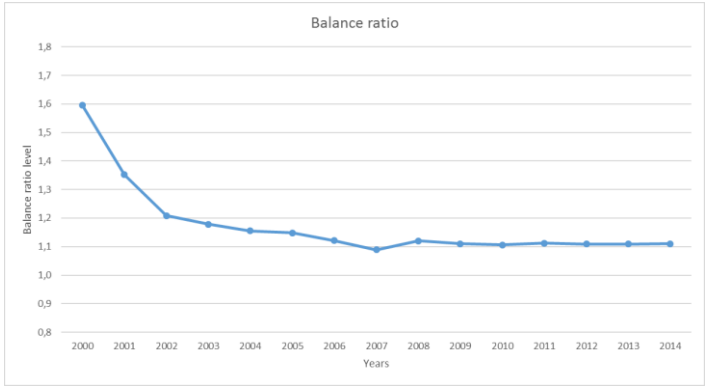
Share	Indexed reference remuneration to the indexante dos apoios sociais – IAS	Rates
1	Up to 1.1xIAS	2.3%
2	Above 1.1 x IAS until 2 x IAS	2.25%
3	Above 2 x IAS until 4 x IAS	2.2%
4	Above 4 x IAS until 8 x IAS	2.1%
5	Above 8 x IAS	2%

Table 1 – Annual tax rate to be considered in the accrual tax rate to the calculation of the Global formation tax. Source: Social security website.

Appendix 2 – Simulation results

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Historical real rate of return of the social security reserve fund	------	**1,63%**	**0,95%**	**-0,20%**	**4,46%**	**3,45%**	**4,44%**	**3,20%**	**0,98%**	**-5,35%**	**5,28%**	**-2,08%**	**-13,39%**	**20,64%**	**5,97%**	**14,74%**
F (without the inicial capital)	3 554 319 100															
C	5 836 477 920	6 288 812 300	6 837 814 185	7 307 775 287	7 593 039 686	7 954 268 332	8 312 257 188	8 717 944 435	9 074 039 412	9 664 070 349	9 655 177 840	9 864 201 984	9 610 192 502	9 310 159 690	9 043 771 744	9 166 537 632
Assets: F and C capitalized (at the real rate of return and including the initial capital)	13 189 437 020	19 795 744 784	26 886 577 778	34 125 964 360	43 579 671 626	53 311 860 887	64 360 228 918	75 416 674 900	85 318 723 313	89 901 214 201	104 812 969 540	112 291 886 357	105 579 390 500	138 602 753 349	156 461 022 641	190 041 062 657
NPW	5 826 684 923	12 401 042 400	19 890 498 961	28 245 915 282	36 992 082 845	46 162 673 697	56 034 822 453	67 249 272 123	78 347 275 940	90 323 172 987	100 466 457 690	110 666 338 925	119 035 642 409	122 812 914 812	128 261 548 212	137 096 433 555
P	0	606 518	342 999	283 226	462 209	1 266 524	2 397 057	970 647	1 439 029	970 249	1 362 171	1 671 505	3 791 619	3 388 820	1 923 926	310 986
b (without the ABM activation)	----	1,60	1,35	1,21	1,18	1,15	1,15	1,12	1,09	1,12	1,11	1,11	1,11	1,11	1,11	1,11
balance index	----	1,60	1,35	1,21	1,18	1,15	1,15	1,12	1,09	1,12	1,11	1,11	1,11	1,11	1,11	1,11

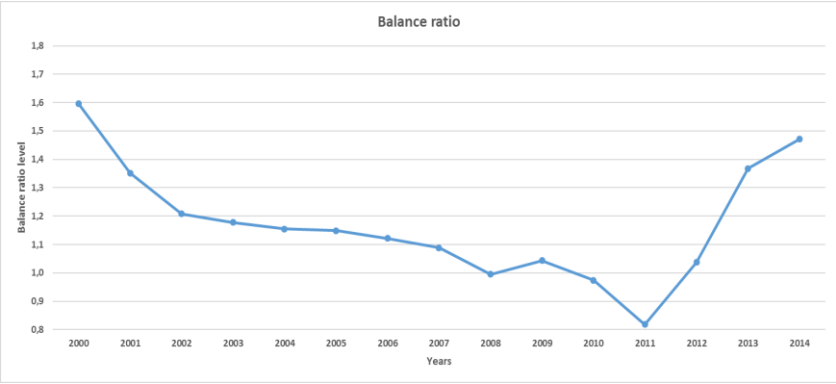
Table 2 – Model 1: Evolution of the balance ration value and its rubrics between 1999 and 2014. Values in euros. Source: author's calculations and Conta da Segurança Social 2014.



Graphic 1 –Model 1: Evolution of balance ratio value between 1999 and 2014. Source: Author's calculations.

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Historical real rate of return of the social security reserve fund (relatório e contas da segurança social	------	1,63%	0,95%	-0,20%	4,46%	3,45%	4,44%	3,20%	0,98%	-5,35%	5,28%	-2,08%	-13,39%	20,64%	5,97%	14,74%
F (without the inicial capital)	3 554 319 100															
C	5 836 477 920	6 288 812 300	6 837 814 185	7 307 775 287	7 593 039 686	7 954 268 332	8 312 257 188	8 717 944 435	9 074 039 412	9 664 070 349	9 655 177 840	9 864 201 984	9 610 192 502	9 310 159 690	9 043 771 744	9 166 537 632
Assets: F and C capitalized (at the real rate of return and including the initial capital)	13 189 437 020	19 795 744 784	26 886 577 778	34 125 964 360	43 579 671 626	53 311 860 887	64 360 228 918	75 416 674 900	85 318 723 313	89 901 214 201	104 812 969 540	112 291 886 357	105 579 390 500	138 602 753 349	156 461 022 641	190 041 062 657
NPW	5 826 684 923	12 401 042 400	19 890 498 961	28 245 915 282	36 992 082 845	46 162 673 697	56 034 822 453	67 249 272 123	78 347 275 940	90 323 172 987	100 466 457 690	115 231 761 825	128 922 289 909	133 597 423 247	114 419 985 773	129 148 065 416
P	0	606 518	342 999	283 226	462 209	1 266 524	2 397 057	970 647	1 439 029	970 249	1 362 171	1 740 248	4 119 017	3 716 873	1 739 858	294 663
b (without the ABM activation)	----	1,60	1,35	1,21	1,18	1,15	1,15	1,12	1,09	0,9953	1,04	0,97	0,82	1,04	1,37	1,47
balance index	----	1,60	1,35	1,21	1,18	1,15	1,15	1,12	1,09	1,04	1,04	1,01	0,82	1,05	1,37	1,47

Table 3 – Model 2: Evolution of the balance ration value and its rubrics between 1999 and 2014. Values in euros. Source: author's calculations and Conta da Segurança Social 2014.



Graphic 2 – Model 2: Evolution of balance ratio value between 1999 and 2014. Source: Author's calculations.

Appendix 3 – Impact of the ABM activation on pension rights and in payment

Annual pensions in payment by age due the new system (in euros)																
Age/year	1 999	2 000	2 001	2 002	2 003	2 004	2 005	2 006	2 007	2 008	2 009	2 010	2 011	2 012	2 013	2 014
55	0	43	67	92	121	151	182	224	248	282	323	379	442	481	434	484
56	0	43	44	70	96	124	154	186	227	250	290	341	403	442	394	447
57	0	43	44	46	73	98	127	157	188	229	257	306	363	404	362	406
58	0	43	44	46	48	74	100	129	159	190	236	271	325	363	331	372
59	0	43	44	46	48	49	76	102	131	160	195	249	289	325	298	340
60	0	43	44	46	48	49	50	78	103	132	165	206	265	289	267	306
61	0	43	44	46	48	49	50	51	78	104	136	174	219	265	237	274
62	0	43	44	46	48	49	50	51	51	79	107	143	185	219	217	243
63	0	0	44	46	47	49	50	51	51	52	82	113	152	185	180	223
64	0	0	0	46	47	49	50	51	51	52	53	86	120	152	152	185
65	0	0	0	0	47	48	50	51	51	52	53	56	91	120	125	156
66	0	0	0	0	0	48	50	51	51	52	53	56	60	92	99	128
67	0	0	0	0	0	0	50	50	51	52	53	56	60	60	75	101
68	0	0	0	0	0	0	0	50	51	52	53	56	60	60	49	77
69	0	0	0	0	0	0	0	0	51	52	53	56	60	60	49	50
70	0	0	0	0	0	0	0	0	0	52	53	56	60	60	49	50
71	0	0	0	0	0	0	0	0	0	0	53	56	60	60	49	50
72	0	0	0	0	0	0	0	0	0	0	0	56	60	60	49	50
73	0	0	0	0	0	0	0	0	0	0	0	0	60	60	49	50
74	0	0	0	0	0	0	0	0	0	0	0	0	0	60	49	50
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	49	50
76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50
77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
87	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
93	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Average		43	46	53	61	70	80	91	103	115	130	151	175	191	170	188

Table 4 – Model 2: Annual pensions in payment due the new system with the ABM activation. Source: Author's calculations.

Annual pensions in payment by age due the new system (in euros)																
Age/year	1 999	2 000	2 001	2 002	2 003	2 004	2 005	2 006	2 007	2 008	2 009	2 010	2 011	2 012	2 013	2 014
55	0	43	67	92	121	151	182	224	248	282	323	379	442	481	434	484
56	0	43	44	70	96	124	154	186	227	250	290	322	381	431	403	408
57	0	43	44	46	73	98	127	157	188	229	257	289	342	394	370	370
58	0	43	44	46	48	74	100	129	159	190	236	256	307	354	338	340
59	0	43	44	46	48	49	76	102	131	160	195	235	272	317	304	311
60	0	43	44	46	48	49	50	78	103	132	165	195	250	281	273	280
61	0	43	44	46	48	49	50	51	78	104	136	165	207	258	242	251
62	0	43	44	46	48	49	50	51	51	79	107	135	175	214	222	222
63	0	0	44	46	47	49	50	51	51	52	82	107	144	181	184	204
64	0	0	0	46	47	49	50	51	51	52	53	81	113	148	155	169
65	0	0	0	0	47	48	50	51	51	52	53	53	86	117	128	143
66	0	0	0	0	0	48	50	51	51	52	53	53	56	89	101	117
67	0	0	0	0	0	0	50	50	51	52	53	53	56	58	77	93
68	0	0	0	0	0	0	0	50	51	52	53	53	56	58	50	70
69	0	0	0	0	0	0	0	0	51	52	53	53	56	58	50	46
70	0	0	0	0	0	0	0	0	0	52	53	53	56	58	50	46
71	0	0	0	0	0	0	0	0	0	0	53	53	56	58	50	46
72	0	0	0	0	0	0	0	0	0	0	0	53	56	58	50	46
73	0	0	0	0	0	0	0	0	0	0	0	0	56	58	50	46
74	0	0	0	0	0	0	0	0	0	0	0	0	0	58	50	46
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	46
76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46
77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
87	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
93	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Average		43	46	53	61	70	80	91	103	115	130	144	167	187	173	174

Table 5 – Model 2: Annual pensions in payment due the new system without the ABM activation. Source: Author's calculations.

Relative impact of the ABM activation

Annual pensions in payment by age due the new system (in euros)

Age/year	1 999	2 000	2 001	2 002	2 003	2 004	2 005	2 006	2 007	2 008	2 009	2 010	2 011	2 012	2 013	2 014
55	-----	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%
56	-----	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-2,2%	9,5%
57	-----	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-2,2%	9,5%
58	-----	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-2,2%	9,5%
59	-----	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-2,2%	9,5%
60	-----	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-2,2%	9,5%
61	-----	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-2,2%	9,5%
62	-----	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-2,2%	9,5%
63	-----	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-2,2%	9,5%
64	-----	-----	-----	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-2,2%	9,5%
65	-----	-----	-----	-----	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-2,2%	9,5%
66	-----	-----	-----	-----	-----	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-2,2%	9,5%
67	-----	-----	-----	-----	-----	-----	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-2,2%	9,5%
68	-----	-----	-----	-----	-----	-----	-----	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-2,2%	9,5%
69	-----	-----	-----	-----	-----	-----	-----	-----	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-2,2%	9,5%
70	-----	-----	-----	-----	-----	-----	-----	-----	-----	0,0%	0,0%	5,8%	6,0%	2,6%	-2,2%	9,5%
71	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0,0%	5,8%	6,0%	2,6%	-2,2%	9,5%
72	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5,8%	6,0%	2,6%	-2,2%	9,5%
73	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	6,0%	2,6%	-2,2%	9,5%
74	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2,6%	-2,2%	9,5%
75	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-2,2%	9,5%
76	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	9,5%
77	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
78	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
79	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
80	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
81	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
82	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
83	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
84	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
85	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
86	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
87	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
88	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
89	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
90	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
91	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
92	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
93	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
94	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
96	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
97	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
98	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
99	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
100	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Average	----	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-2,2%	9,5%

Table 6 – Model 2: Relative impact of the ABM activation on pensions in payment due the new system. Source: Author's calculations.

NPW per age due the new system (in euros)

Age/year	1 999	2 000	2 001	2 002	2 003	2 004	2 005	2 006	2 007	2 008	2 009	2 010	2 011	2 012	2 013	2 014
15	1 313	1 371	1 452	1 534	1 593	1 655	1 713	1 762	1 805	1 888	1 943	2 013	2 027	2 047	2 041	2 037
16	1 313	2 732	2 883	3 073	3 213	3 309	3 431	3 534	3 617	3 738	3 918	4 176	4 291	4 128	3 388	4 267
17	1 313	2 732	4 304	4 588	4 838	4 991	5 148	5 312	5 440	5 594	5 852	6 291	6 628	6 429	5 120	5 673
18	1 313	2 732	4 303	6 093	6 438	6 678	6 894	7 089	7 267	7 461	7 793	8 362	8 913	8 804	7 035	7 482
19	1 313	2 731	4 303	6 092	8 027	8 338	8 645	8 895	9 094	9 333	9 745	10 439	11 151	11 126	9 012	9 482
20	1 313	2 731	4 302	6 092	8 026	9 988	10 369	10 707	10 952	11 205	11 702	12 529	13 396	13 400	10 945	11 547
21	1 313	2 731	4 302	6 091	8 025	9 987	12 081	12 490	12 814	13 107	13 659	14 625	15 654	15 682	12 838	13 565
22	1 313	2 731	4 302	6 091	8 025	9 986	12 080	14 262	14 649	15 016	15 649	16 720	17 919	17 977	14 737	15 542
23	1 313	2 731	4 302	6 091	8 025	9 986	12 079	14 261	16 470	16 895	17 644	18 850	20 183	20 279	16 648	17 526
24	1 313	2 731	4 302	6 091	8 025	9 986	12 079	14 260	16 469	18 761	19 609	20 987	22 485	22 580	18 564	19 522
25	1 313	2 731	4 302	6 091	8 024	9 985	12 079	14 259	16 468	18 759	21 559	23 089	24 793	24 919	20 479	21 522
26	1 313	2 731	4 302	6 091	8 024	9 985	12 078	14 258	16 467	18 758	21 557	25 177	27 064	27 264	22 425	23 522
27	1 313	2 731	4 302	6 090	8 023	9 984	12 077	14 257	16 465	18 755	21 555	25 174	29 319	29 571	24 376	25 554
28	1 313	2 731	4 301	6 090	8 023	9 983	12 076	14 256	16 464	18 754	21 552	25 171	29 315	31 862	26 296	27 590
29	1 313	2 731	4 301	6 089	8 022	9 982	12 074	14 253	16 461	18 750	21 548	25 166	29 309	31 855	28 201	29 593
30	1 313	2 731	4 301	6 089	8 021	9 981	12 073	14 252	16 459	18 748	21 546	25 163	29 305	31 851	28 196	31 584
31	1 313	2 731	4 301	6 089	8 021	9 981	12 073	14 252	16 458	18 747	21 545	25 161	29 303	31 848	28 193	31 580
32	1 313	2 731	4 301	6 089	8 021	9 980	12 072	14 250	16 457	18 745	21 542	25 158	29 299	31 843	28 189	31 574
33	1 313	2 730	4 301	6 088	8 020	9 979	12 071	14 249	16 455	18 743	21 539	25 154	29 295	31 838	28 184	31 569
34	1 312	2 730	4 300	6 088	8 020	9 978	12 069	14 247	16 452	18 740	21 535	25 150	29 289	31 832	28 178	31 562
35	1 312	2 730	4 299	6 086	8 018	9 976	12 066	14 243	16 448	18 734	21 529	25 142	29 280	31 821	28 169	31 551
36	1 312	2 730	4 299	6 086	8 016	9 974	12 064	14 241	16 445	18 731	21 524	25 136	29 273	31 813	28 161	31 543
37	1 312	2 730	4 299	6 085	8 015	9 972	12 062	14 238	16 441	18 726	21 519	25 129	29 264	31 804	28 153	31 533
38	1 312	2 729	4 298	6 083	8 013	9 969	12 058	14 233	16 435	18 719	21 510	25 119	29 252	31 790	28 140	31 518
39	1 312	2 729	4 297	6 082	8 011	9 966	12 054	14 227	16 429	18 712	21 501	25 108	29 239	31 775	28 126	31 502
40	1 312	2 728	4 296	6 081	8 009	9 964	12 051	14 223	16 423	18 705	21 494	25 099	29 227	31 762	28 114	31 488
41	1 311	2 727	4 295	6 078	8 005	9 959	12 044	14 215	16 413	18 693	21 478	25 081	29 206	31 737	28 092	31 463
42	1 311	2 727	4 293	6 076	8 002	9 954	12 037	14 206	16 403	18 680	21 463	25 063	29 184	31 713	28 070	31 438
43	1 311	2 726	4 292	6 073	7 998	9 948	12 030	14 197	16 391	18 666	21 447	25 042	29 159	31 685	28 044	31 409
44	1 311	2 725	4 290	6 071	7 994	9 943	12 022	14 188	16 379	18 652	21 430	25 021	29 133	31 656	28 017	31 378
45	1 311	2 725	4 289	6 068	7 990	9 937	12 015	14 177	16 367	18 637	21 411	24 998	29 105	31 624	27 988	31 345
46	1 310	2 723	4 287	6 065	7 984	9 929	12 004	14 164	16 350	18 617	21 387	24 968	29 069	31 583	27 951	31 302
47	1 310	2 723	4 285	6 061	7 979	9 922	11 994	14 151	16 334	18 597	21 362	24 939	29 033	31 542	27 913	31 258
48	1 310	2 722	4 284	6 059	7 975	9 916	11 986	14 140	16 320	18 580	21 341	24 912	29 000	31 504	27 878	31 218
49	1 309	2 721	4 282	6 056	7 970	9 909	11 976	14 127	16 303	18 559	21 315	24 880	28 960	31 459	27 836	31 170
50	1 309	2 720	4 279	6 052	7 964	9 900	11 964	14 111	16 284	18 535	21 286	24 844	28 916	31 409	27 790	31 116
51	1 309	2 719	4 277	6 048	7 958	9 891	11 953	14 097	16 265	18 512	21 258	24 809	28 872	31 358	27 743	31 062
52	1 308	2 717	4 273	6 041	7 949	9 879	11 936	14 076	16 239	18 481	21 220	24 762	28 815	31 293	27 682	30 992
53	1 308	2 716	4 271	6 037	7 942	9 869	11 923	14 058	16 217	18 453	21 186	24 720	28 763	31 234	27 627	30 928
54	1 308	2 715	4 269	6 033	7 935	9 859	11 910	14 041	16 195	18 426	21 153	24 678	28 712	31 174	27 571	30 864
55	1 307	2 670	4 198	5 757	7 579	9 428	11 389	14 017	15 480	17 597	20 217	23 696	27 600	30 071	27 148	30 280
56	1 306	2 669	4 174	5 751	7 357	9 130	11 017	13 476	15 535	16 950	19 436	22 750	26 626	29 022	26 257	29 867
57	1 306	2 668	4 171	5 792	7 420	8 970	10 783	13 091	15 061	17 092	18 850	22 002	25 666	28 116	25 410	28 980
58	1 306	2 666	4 168	5 787	7 530	9 102	10 684	12 844	14 741	16 684	19 076	21 454	24 938	27 188	24 673	28 122
59	1 305	2 665	4 166	5 783	7 523	9 283	10 891	12 741	14 564	16 439	18 735	21 779	24 437	26 529	23 929	27 386
60	1 304	2 663	4 162	5 776	7 514	9 270	11 140	12 945	14 522	16 327	18 551	21 484	24 857	26 085	23 393	26 630
61	1 304	2 661	4 157	5 768	7 502	9 254	11 119	13 194	14 796	16 350	18 503	21 355	24 609	26 571	23 036	26 090
62	0	2 659	4 153	5 762	7 492	9 239	11 100	13 169	15 118	16 700	18 600	21 378	24 549	26 391	23 448	25 745
63	0	0	4 151	5 756	7 483	9 226	11 082	13 145	15 088	17 099	19 035	21 550	24 648	26 398	23 323	26 187
64	0	0	0	5 748	7 470	9 208	11 058	13 114	15 050	17 052	19 506	22 068	24 885	26 547	23 331	26 074
65	0	0	0	0	7 455	9 188	11 031	13 079	15 007	17 000	19 443	22 624	25 498	26 835	23 457	26 091
66	0	0	0	0	0	9 166	11 002	13 042	14 961	16 944	19 375	22 541	26 151	27 502	23 700	26 233
67	0	0	0	0	0	0	10 972	13 004	14 912	16 885	19 304	22 453	26 043	28 207	24 252	26 493
68	0	0	0	0	0	0	0	12 947	14 844	16 803	19 205	22 334	25 899	28 044	24 806	27 037
69	0	0	0	0	0	0	0	0	14 772	16 717	19 101	22 206	25 745	27 871	24 647	27 609
70	0	0	0	0	0	0	0	0	0	16 618	18 982	22 062	25 570	27 674	24 467	27 403
Average	1 311	2 689	4 184	5 835	7 579	9 304	11 107	13 005	14 813	16 646	18 870	21 745	24 966	26 749	23 418	25 975

Table 7 – Model 2: NPW per age due the new system with the ABM activation. Source: Author's calculations.

NPW per age due the new system (in euros)																	
Age/year	1 999	2 000	2 001	2 002	2 003	2 004	2 005	2 006	2 007	2 008	2 009	2 010	2 011	2 012	2 013	2 014
15	1 313	1 371	1 452	1 534	1 593	1 655	1 713	1 762	1 805	1 888	1 943	2 013	2 027	2 047	2 041	2 037
16	1 313	2 732	2 883	3 073	3 213	3 309	3 431	3 534	3 617	3 738	3 918	3 949	4 048	4 023	2 444	1 918
17	1 313	2 732	4 304	4 588	4 838	4 991	5 148	5 312	5 440	5 594	5 852	5 948	6 254	6 266	4 927	3 182
18	1 313	2 732	4 303	6 093	6 438	6 678	6 894	7 089	7 267	7 461	7 793	7 906	8 410	8 581	7 674	4 809
19	1 313	2 731	4 303	6 092	8 027	8 338	8 645	8 895	9 094	9 333	9 745	9 870	10 521	10 844	10 510	6 608
20	1 313	2 731	4 302	6 092	8 026	9 988	10 369	10 707	10 952	11 205	11 702	11 846	12 640	13 061	13 282	8 466
21	1 313	2 731	4 302	6 091	8 025	9 987	12 081	12 490	12 814	13 107	13 659	13 827	14 770	15 284	15 996	10 281
22	1 313	2 731	4 302	6 091	8 025	9 986	12 080	14 262	14 649	15 016	15 649	15 808	16 907	17 521	18 719	12 059
23	1 313	2 731	4 302	6 091	8 025	9 986	12 079	14 261	16 470	16 895	17 644	17 822	19 043	19 765	21 459	13 843
24	1 313	2 731	4 302	6 091	8 025	9 986	12 079	14 260	16 469	18 761	19 609	19 842	21 216	22 008	24 207	15 638
25	1 313	2 731	4 302	6 091	8 024	9 985	12 079	14 259	16 468	18 759	21 559	21 830	23 393	24 287	26 954	17 438
26	1 313	2 731	4 302	6 091	8 024	9 985	12 078	14 258	16 467	18 758	21 557	23 804	25 536	26 573	29 746	19 237
27	1 313	2 731	4 302	6 090	8 023	9 984	12 077	14 257	16 465	18 755	21 555	23 801	27 664	28 822	32 545	21 065
28	1 313	2 731	4 301	6 090	8 023	9 983	12 076	14 256	16 464	18 754	21 552	23 798	27 660	31 055	35 300	22 898
29	1 313	2 731	4 301	6 089	8 022	9 982	12 074	14 253	16 461	18 750	21 548	23 793	27 654	31 048	38 034	24 702
30	1 313	2 731	4 301	6 089	8 021	9 981	12 073	14 252	16 459	18 748	21 546	23 790	27 651	31 043	38 026	26 490
31	1 313	2 731	4 301	6 089	8 021	9 981	12 073	14 252	16 458	18 747	21 545	23 789	27 649	31 041	38 021	26 486
32	1 313	2 731	4 301	6 089	8 021	9 980	12 072	14 250	16 457	18 745	21 542	23 786	27 645	31 036	38 017	26 484
33	1 313	2 730	4 301	6 088	8 020	9 979	12 071	14 249	16 455	18 743	21 539	23 782	27 641	31 031	38 012	26 479
34	1 312	2 730	4 300	6 088	8 020	9 978	12 069	14 247	16 452	18 740	21 535	23 778	27 635	31 025	38 006	26 475
35	1 312	2 730	4 299	6 086	8 018	9 976	12 066	14 243	16 448	18 734	21 529	23 771	27 627	31 015	37 998	26 470
36	1 312	2 730	4 299	6 086	8 016	9 974	12 064	14 241	16 445	18 731	21 524	23 765	27 620	31 007	37 986	26 461
37	1 312	2 730	4 299	6 085	8 015	9 972	12 062	14 238	16 441	18 726	21 519	23 759	27 612	30 998	37 976	26 454
38	1 312	2 729	4 298	6 083	8 013	9 969	12 058	14 233	16 435	18 719	21 510	23 749	27 600	30 984	37 965	26 445
39	1 312	2 729	4 297	6 082	8 011	9 966	12 054	14 227	16 429	18 712	21 501	23 739	27 588	30 969	37 948	26 434
40	1 312	2 728	4 296	6 081	8 009	9 964	12 051	14 223	16 423	18 705	21 494	23 730	27 577	30 957	37 930	26 420
41	1 311	2 727	4 295	6 078	8 005	9 959	12 044	14 215	16 413	18 693	21 478	23 713	27 556	30 933	37 914	26 409
42	1 311	2 727	4 293	6 076	8 002	9 954	12 037	14 206	16 403	18 680	21 463	23 696	27 536	30 909	37 886	26 388
43	1 311	2 726	4 292	6 073	7 998	9 948	12 030	14 197	16 391	18 666	21 447	23 676	27 513	30 882	37 856	26 367
44	1 311	2 725	4 290	6 071	7 994	9 943	12 022	14 188	16 379	18 652	21 430	23 656	27 488	30 854	37 823	26 344
45	1 311	2 725	4 289	6 068	7 990	9 937	12 015	14 177	16 367	18 637	21 411	23 635	27 462	30 822	37 788	26 318
46	1 310	2 723	4 287	6 065	7 984	9 929	12 004	14 164	16 350	18 617	21 387	23 607	27 428	30 783	37 750	26 291
47	1 310	2 723	4 285	6 061	7 979	9 922	11 994	14 151	16 334	18 597	21 362	23 578	27 393	30 742	37 701	26 256
48	1 310	2 722	4 284	6 059	7 975	9 916	11 986	14 140	16 320	18 580	21 341	23 553	27 362	30 706	37 652	26 220
49	1 309	2 721	4 282	6 056	7 970	9 909	11 976	14 127	16 303	18 559	21 315	23 523	27 325	30 662	37 607	26 187
50	1 309	2 720	4 279	6 052	7 964	9 900	11 964	14 111	16 284	18 535	21 286	23 489	27 284	30 613	37 554	26 148
51	1 309	2 719	4 277	6 048	7 958	9 891	11 953	14 097	16 265	18 512	21 258	23 456	27 242	30 564	37 494	26 104
52	1 308	2 717	4 273	6 041	7 949	9 879	11 936	14 076	16 239	18 481	21 220	23 411	27 188	30 500	37 433	26 060
53	1 308	2 716	4 271	6 037	7 942	9 869	11 923	14 058	16 217	18 453	21 186	23 372	27 139	30 442	37 355	26 003
54	1 308	2 715	4 269	6 033	7 935	9 859	11 910	14 041	16 195	18 426	21 153	23 332	27 090	30 384	37 284	25 952
55	1 307	2 670	4 198	5 757	7 579	9 428	11 389	14 017	15 480	17 597	20 217	22 404	26 042	29 309	37 213	25 899
56	1 306	2 669	4 174	5 751	7 357	9 130	11 017	13 476	15 535	16 950	19 436	21 510	25 123	28 287	35 897	25 501
57	1 306	2 668	4 171	5 792	7 420	8 970	10 783	13 091	15 061	17 092	18 850	20 802	24 217	27 403	34 645	24 665
58	1 306	2 666	4 168	5 787	7 530	9 102	10 684	12 844	14 741	16 684	19 076	20 284	23 530	26 498	33 563	23 870
59	1 305	2 665	4 166	5 783	7 523	9 283	10 891	12 741	14 564	16 439	18 735	20 591	23 057	25 856	32 454	23 177
60	1 304	2 663	4 162	5 776	7 514	9 270	11 140	12 945	14 522	16 327	18 551	20 312	23 454	25 424	31 668	22 478
61	1 304	2 661	4 157	5 768	7 502	9 254	11 119	13 194	14 796	16 350	18 503	20 191	23 220	25 898	31 138	21 974
62	0	2 659	4 153	5 762	7 492	9 239	11 100	13 169	15 118	16 700	18 600	20 212	23 163	25 722	31 719	21 639
63	0	0	4 151	5 756	7 483	9 226	11 082	13 145	15 088	17 099	19 035	20 374	23 256	25 729	31 504	22 026
64	0	0	0	5 748	7 470	9 208	11 058	13 114	15 050	17 052	19 506	20 864	23 480	25 874	31 512	21 909
65	0	0	0	0	7 455	9 188	11 031	13 079	15 007	17 000	19 443	21 390	24 059	26 155	31 689	21 916
66	0	0	0	0	0	9 166	11 002	13 042	14 961	16 944	19 375	21 311	24 674	26 805	32 033	22 035
67	0	0	0	0	0	0	10 972	13 004	14 912	16 885	19 304	21 228	24 573	27 492	32 830	22 263
68	0	0	0	0	0	0	0	12 947	14 844	16 803	19 205	21 115	24 436	27 334	33 671	22 781
69	0	0	0	0	0	0	0	0	14 772	16 717	19 101	20 995	24 291	27 164	33 477	23 302
70	0	0	0	0	0	0	0	0	0	16 618	18 982	20 859	24 126	26 972	33 270	23 153
Average	1 311	2 689	4 184	5 835	7 579	9 304	11 107	13 005	14 813	16 646	18 870	20 561	23 559	26 072	31 377	21 623

Table 8 – Model 2: NPW per age due the new system without the ABM activation. Source: Author's calculations.

Relative impact of the ABM activation

NPW per age due the new system (in euros)																
Age/year	1 999	2 000	2 001	2 002	2 003	2 004	2 005	2 006	2 007	2 008	2 009	2 010	2 011	2 012	2 013	2 014
15	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%
16	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	38,6%	122,5%
17	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	3,9%	78,3%
18	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-8,3%	55,6%
19	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-14,2%	43,5%
20	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-17,6%	36,4%
21	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-19,7%	31,9%
22	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-21,3%	28,9%
23	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-22,4%	26,6%
24	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-23,3%	24,8%
25	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-24,0%	23,4%
26	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-24,6%	22,3%
27	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-25,1%	21,3%
28	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-25,5%	20,5%
29	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-25,9%	19,8%
30	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-25,8%	19,2%
31	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-25,8%	19,2%
32	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-25,9%	19,2%
33	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-25,9%	19,2%
34	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-25,9%	19,2%
35	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-25,9%	19,2%
36	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-25,9%	19,2%
37	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-25,9%	19,2%
38	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-25,9%	19,2%
39	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-25,9%	19,2%
40	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-25,9%	19,2%
41	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-25,9%	19,1%
42	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-25,9%	19,1%
43	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-25,9%	19,1%
44	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-25,9%	19,1%
45	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-25,9%	19,1%
46	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-26,0%	19,1%
47	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-26,0%	19,1%
48	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-26,0%	19,1%
49	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-26,0%	19,0%
50	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-26,0%	19,0%
51	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-26,0%	19,0%
52	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-26,0%	18,9%
53	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-26,0%	18,9%
54	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-26,1%	18,9%
55	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-27,0%	16,9%
56	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-26,9%	17,1%
57	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-26,7%	17,5%
58	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-26,5%	17,8%
59	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-26,3%	18,2%
60	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-26,1%	18,5%
61	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-26,0%	18,7%
62	----		0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-26,1%	19,0%
63	----	----		0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-26,0%	18,9%
64	----	----	----		0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-26,0%	19,0%
65	----	----	----	----		0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-26,0%	19,1%
66	----	----	----	----	----		0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-26,0%	19,1%
67	----	----	----	----	----	----		0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-26,1%	19,0%
68	----	----	----	----	----	----	----		0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-26,3%	18,7%
69	----	----	----	----	----	----	----	----		0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-26,4%	18,5%
70	----	----	----	----	----	----	----	----	----		0,0%	0,0%	5,8%	6,0%	2,6%	-26,5%	18,4%
Average	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,8%	6,0%	2,6%	-23,2%	24,1%

Table 9 – Model 2: Relative impact of the ABM activation on NPW due the new system. Source: Author's calculations.

Appendix 4 – Impact of the NDC scheme's introduction on pensions in payment and its comparison with historical results

Average monthly old-age pension																		
Rubric/year	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**Total average**	**Volatility**
Effective pension in euros (1)			314,62	334,02	351,51	373,72	394,73	417,86	436,72	454,24	472,08	482,86	487,89	472,18	497,81	500,81	**427,93**	
Growth rate of the effective pension				6,2%	5,2%	6,3%	5,6%	5,9%	4,5%	4,0%	3,9%	2,3%	1,0%	-3,2%	5,4%	0,6%	**3,676%**	**2,8%**
Simulated NDC pension in euros (2)			46	53	61	70	80	91	103	115	130	145	161	174	188	199	**120,77**	
Growth rate of the simulated NDC pension				13,7%	15,4%	14,3%	14,5%	14,7%	12,6%	11,7%	13,5%	11,1%	11,4%	7,8%	8,0%	6,1%	**11,750%**	**3,0%**

Notes:

(1) Considers the annual average pension divided by 12 months; Source: Conta da Segurança Social 2014, page 275

(2) Considers only pensions derived from the new scheme (Swedish NDC)

- The level of historical and simulated pension cannot be compared, as one system is already in a mature state and the other is still growing (consequently pensions are also increasing with the number of years of contributions)

Table 10 – Model 1: Comparison of the volatility of the average monthly pension in payment with the effective monthly pension. Source: Author's calculations and PORDATA.

Average monthly old-age pension																		
Rubric/year	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**Total average**	**Volatility**
Effective pension (1)			314,62	334,02	351,51	373,72	394,73	417,86	436,72	454,24	472,08	482,86	487,89	472,18	497,81	500,81	**427,93**	
Growth rate of the effective pension				6,2%	5,2%	6,3%	5,6%	5,9%	4,5%	4,0%	3,9%	2,3%	1,0%	-3,2%	5,4%	0,6%	**3,676%**	**2,7%**
Simulated NDC pension (2)	0	43	46	53	61	70	80	91	103	115	130	151	175	191	170	188	**116,00**	
Growth rate of the simulated NDC pension				13,7%	15,4%	14,3%	14,5%	14,7%	12,6%	11,7%	13,5%	15,7%	16,2%	8,8%	-11,1%	11,1%	**11,621%**	**7,1%**

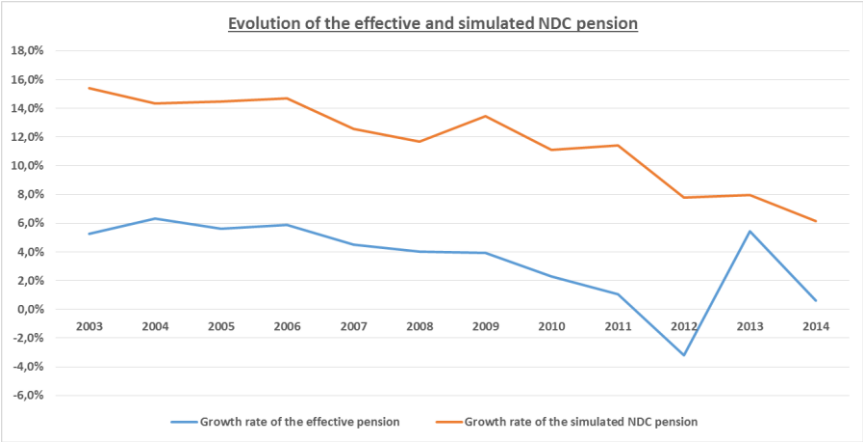
Notes:

(1) Considers the annual average pension divided by 12 months; Source: Conta da Segurança Social 2014, page 275

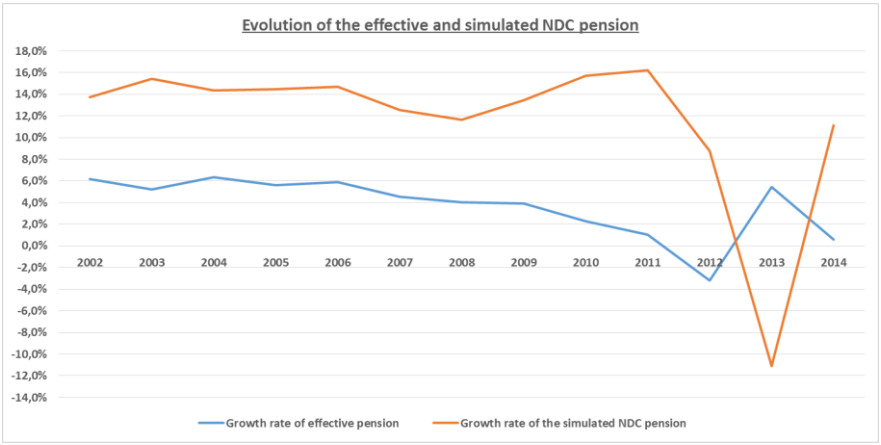
(2) Considers only pensions derived from the new scheme (Swedish NDC)

- The level of historical and simulated pension cannot be compared, as one system is already in a mature state and the other is still growing (consequently pensions are also increasing with the number of years of contributions)

Table 11 – Model 2: Comparison of the volatility of the average monthly pension in payment with the effective monthly pension. Source: Author's calculations and PORDATA.

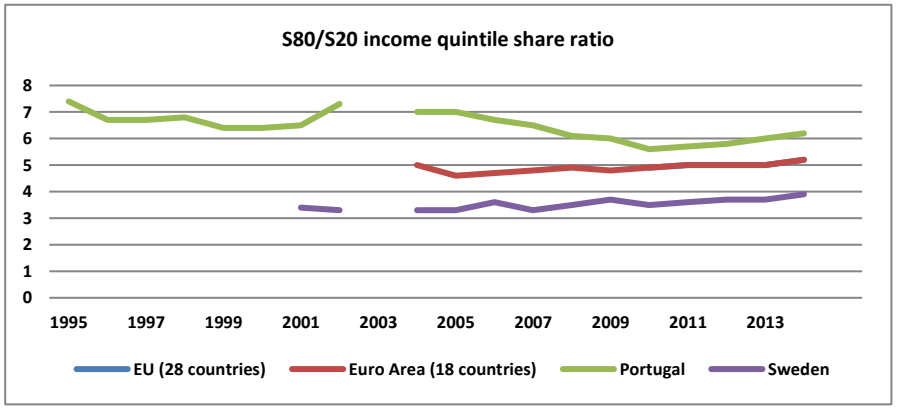


Graphic 3 – Model 1: Evolution of the average effective and simulated NDC pensions in payment. Source: Author's calculation

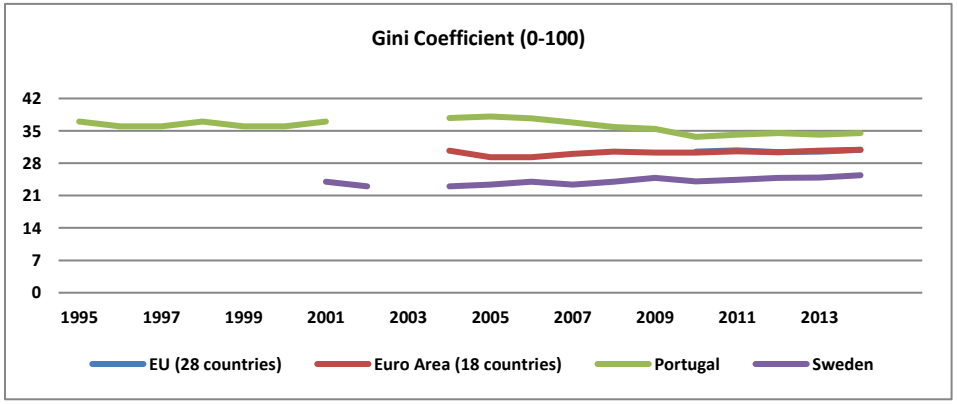


Graphic 4 – Model 2: Evolution of the average effective and simulated NDC pensions in payment. Source: Author's calculations.

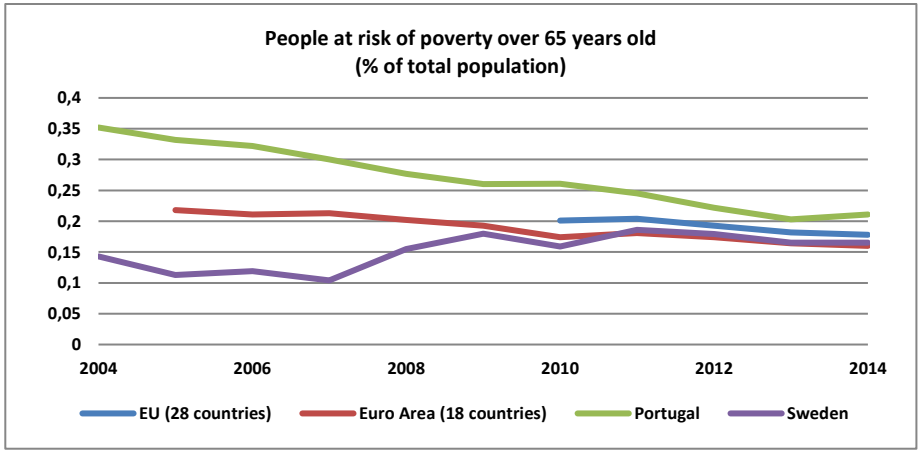
Appendix 5 – Evolution of historical social indicators in Portugal, Sweden, EU and EMU



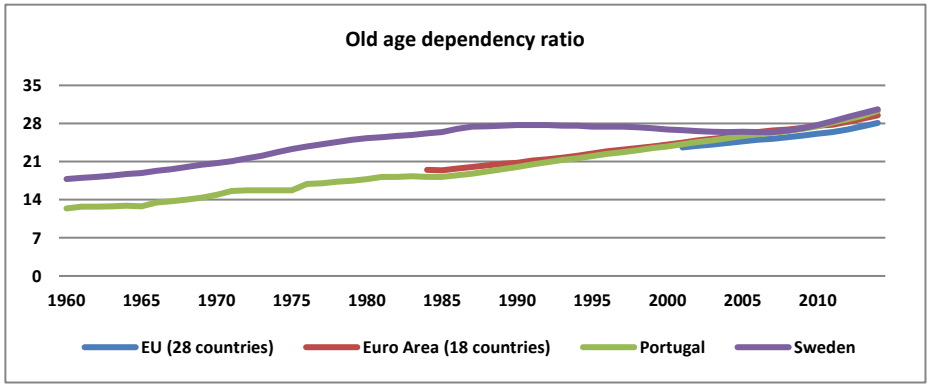
Graphic 5 – S80/S20 income quintile share ratio in Portugal, Sweden, EU and EMU between 1995 and 2014. Source: EUROSTAT.
Observation: EU data available between 2010 and 2014 – values equal to the EMU's.



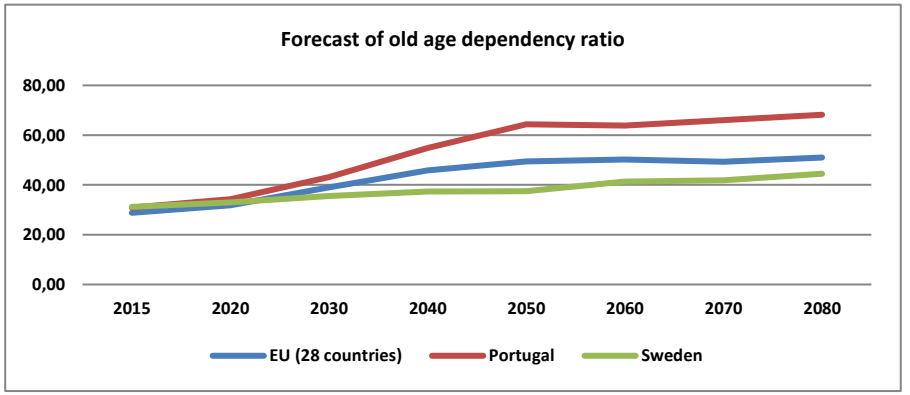
Graphic 6 – Gini coefficient in Portugal, Sweden, EU and EMU between 1995 and 2014. Source: EUROSTAT.



Graphic 7 – People at risk of poverty over 65 years old (% of total population) in Portugal, Sweden, EU and EMU between 2004 and 2014. Source: EUROSTAT.

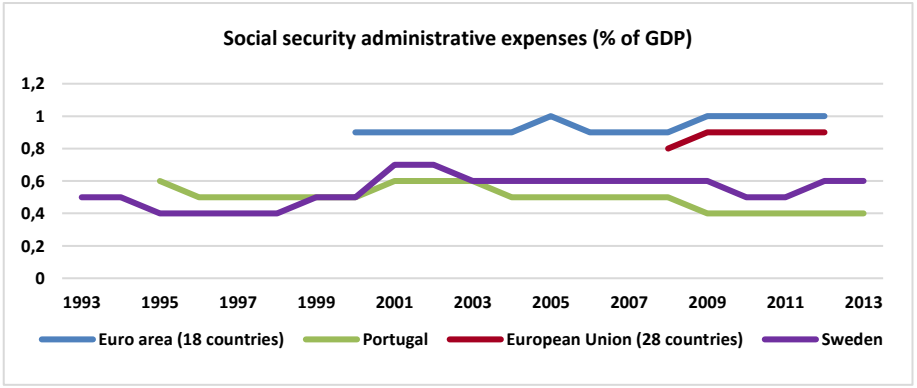


Graphic 8 – Old-age dependency ratio in Portugal, Sweden, EU and EMU between 1960 and 2014. Source: EUROSTAT.

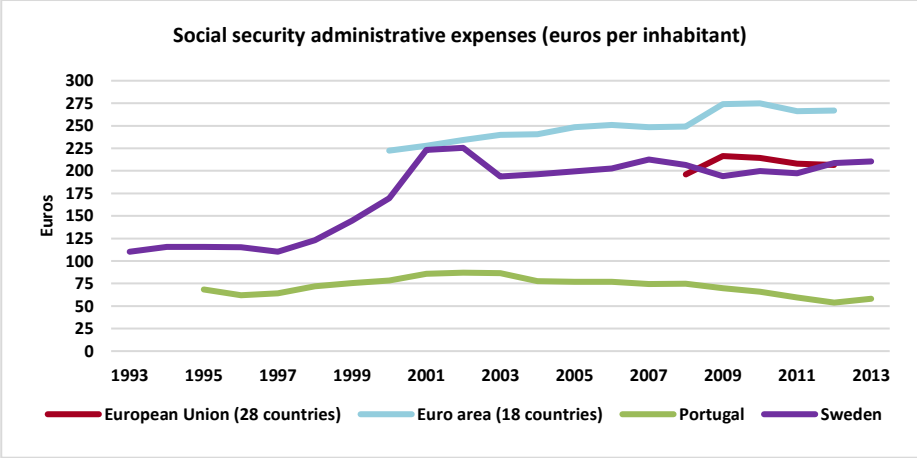


Graphic 9 – Forecast of old-age dependency ratio in Portugal, Sweden, EU and Emu between 2015 and 2080. Source: EUROSTAT.

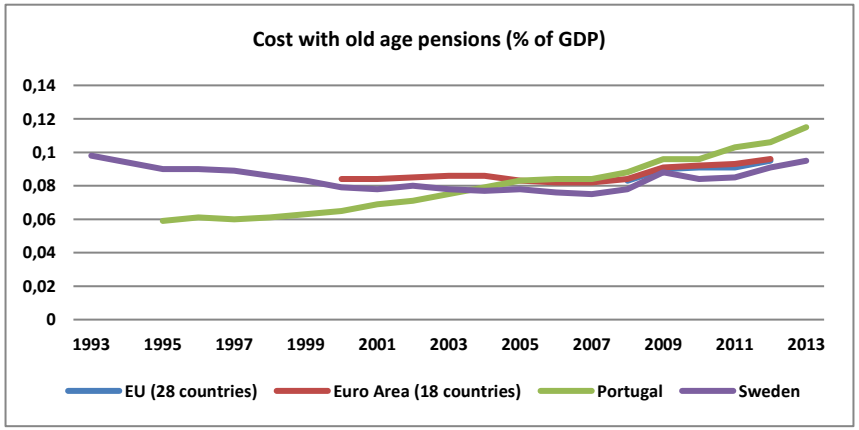
Appendix 6 – Evolution of social security financial indicators in Portugal, Sweden, EU and EMU



Graphic 10 – Social security scheme's administrative expenses (% of GDP) in Portugal, Sweden, EU and EMU between 1993 and 2013. Source: EUROSTAT.

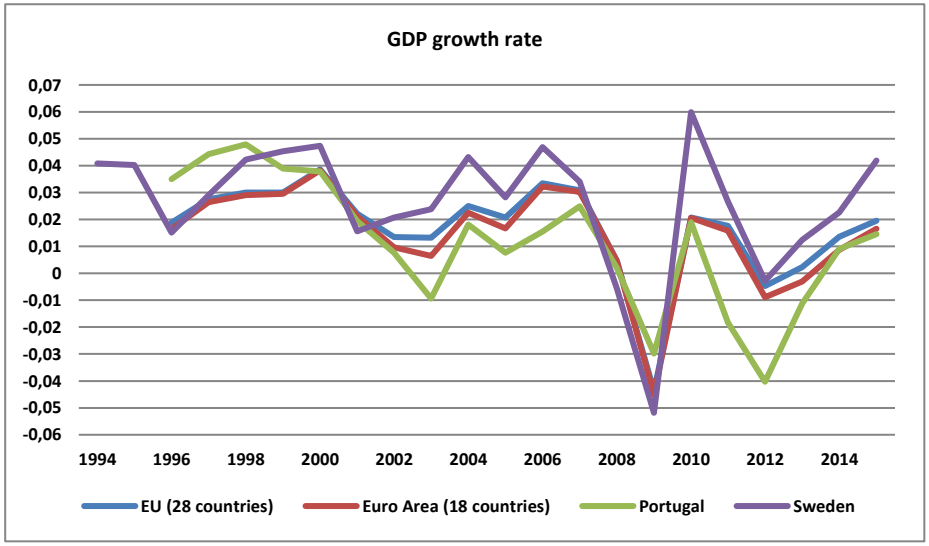


Graphic 11 - Social security scheme's administrative expenses (euros per inhabitant) in Portugal, Sweden, EU and EMU between 1993 and 2013. Source: EUROSTAT.



Graphic 12 – Evolution of costs with old-age pensions (% of GDP) in Portugal, Sweden, EU and EMU between 1993 and 2013. Source: EUROSTAT.

Appendix 7 – Evolution of economic indicators in Portugal, Sweden, EU and EMU



Graphic 13 – GDP growth rate in Portugal, Sweden, EU and EMU between 1994 and 2015. Source: Author's calculations based in EUROSTAT GDP at 2005 constant prices.